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MARCH 1960

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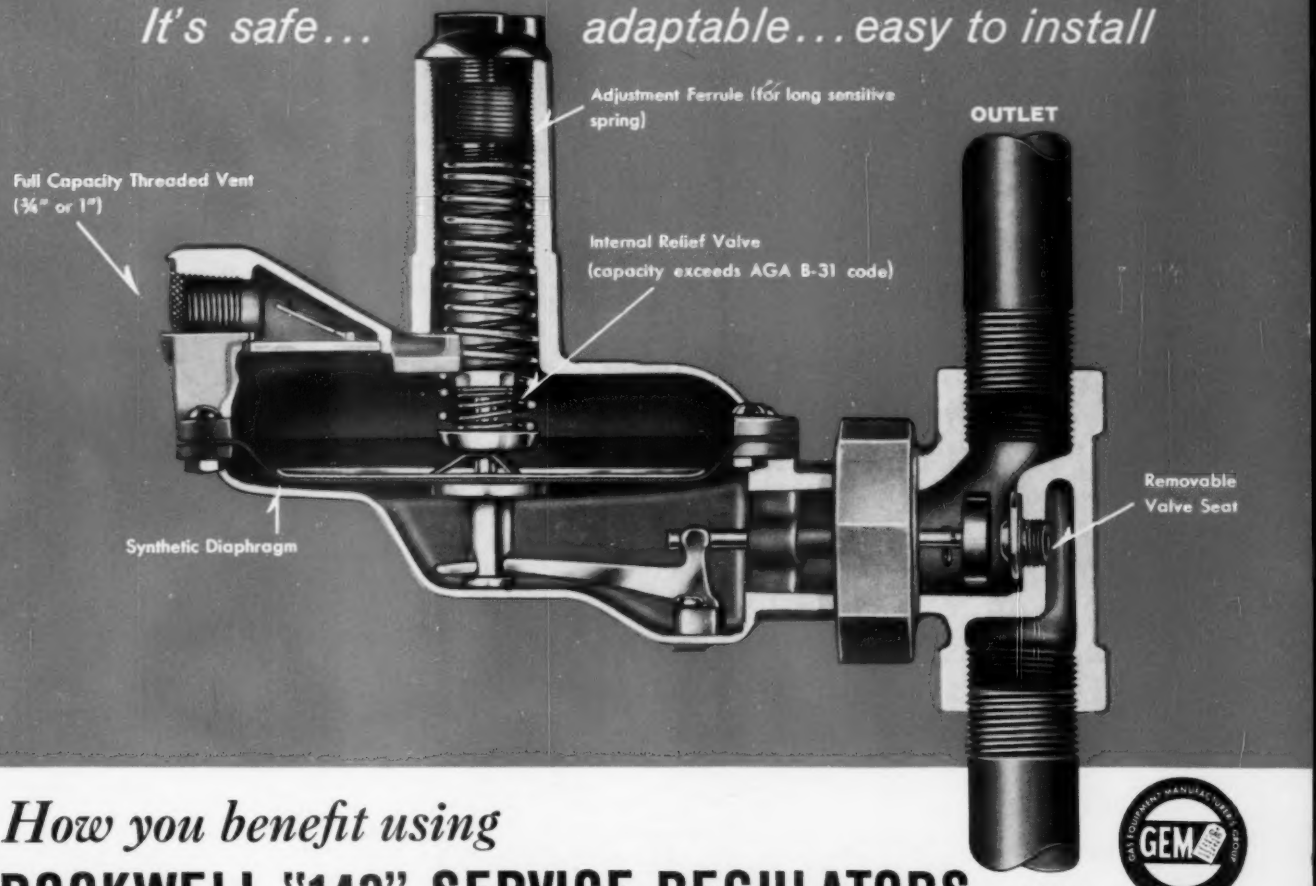
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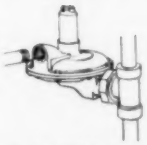
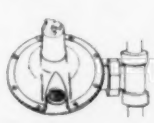
INDOORS 

OUTDOORS 

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GAS

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36TH YEAR OF PUBLICATION

VOLUME THIRTY-SIX · NUMBER 3

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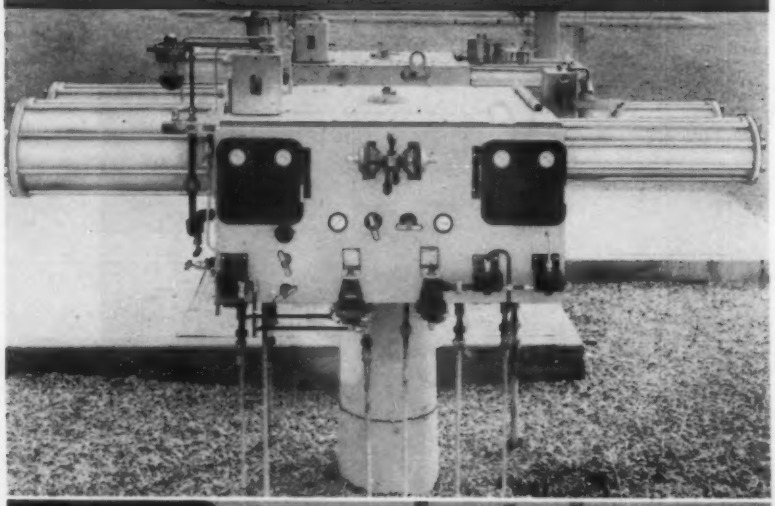

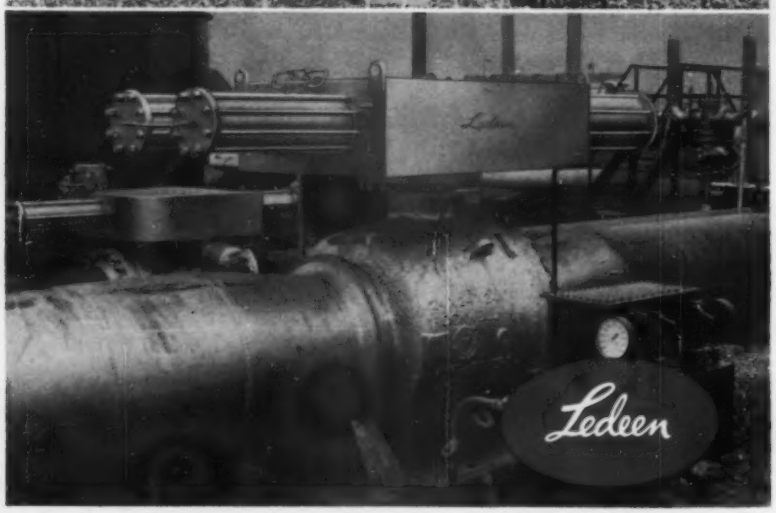

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GAS

MARCH, 1960

Thermally Thinking

DID you ever stop awhile, relax a bit, and think about just what you are doing with the gas company you work for?

I have just finished reading a rather intriguing volume which discusses and appeals autoanalysis. Stripped to bare bones, autoanalysis just means taking a good long look at yourself. The literature left me with two conclusions: (1) I am in need of another start and a new head, and (2) the concept of orient-yourself every now and again is a very good idea.

I will not suggest that all people have to live with the many frustrations, traumas, and neuroses that I have developed through fairly constant association with gas-company public relations people, but all of us have to live with ourselves and our companies.

Having just returned from a field trip to the spreads working on the new Transwestern Pipeline Co. project, I cannot escape the conclusion that most of these contractors' people, the chief inspectors and their inspectors seem to know exactly where they are going. I contrast this with many of the people I visit in mature gas companies who don't seem to have an immediate goal at hand or, if they do, seem to be trying to avoid it or are afraid to really get there.

Take a particular spread superintendent I had the experience (and it was fun) of visiting. R. L. "Bob" Ezell was running an H. C. Price Co. spread out of Kingman, Ariz. (at that time).

Now, Bob is a big man with a lot of responsibility and problems. He had some 375 men and millions of dollars worth of equipment and material spread out over 65 miles or so of the roughest pipelining country on the Transwestern pipeline. He had hard drill-and-shoot rock to trench, too much wind for the welders, mountains, and a few hundred other things to contend with. But you could take one look at the neo-classic features of his perhaps even handsome face and tell he knew he had these problems and that he was confident he could beat them.

Mr. Ezell was relaxed. He was not refusing telephone or radio calls, he was not putting things off, he was not too busy to see people. In fact, he had the time to chat with this itinerant editor, answer my questions with considerable frankness, and offered the use of a helicopter to move around his spread.

Contrast this with yourself and people you know in your gas company. Are you doing a job or holding a job? It doesn't injure any of us to answer this question frankly. Few of us are so busy that we really can't answer that letter, work out that problem, get that answer for somebody else, laugh a little, and see that guy we really are not crazy about chatting with.

I have noticed that many gas company people who are the "just too busy" types have a surprising variety of chores. About half of their impending business is conversations with their stockbroker, lining up a duck hunt at the company's country club, running down a new spring for their overhead garage door at home, and assorted vital matters. Nobody really minds any of this, with the possible exception of the ducks. And I will readily admit that my publisher has bounced into my exquisitely appointed chambers during one of my busy spells and interrupted a very serious appraisal of assorted steeds due to charge in the 7th at Santa Anita.

But we often need to take a look at what we are in relation to our company. We need to see our mountains and get on over them. Too much emphasis has, I think, been placed on what the gas companies should do for their employees. Employees cannot but profit from doing a little deep thinking about what they should be doing for the gas company.

Think about what your job means to the progress of the company. Analyze your performance of your tasks. There is usually enough real work available to keep most gas company people busy without resorting to personal "business," intra-company or interdepartmental politics, and sundry shams.

I guess I should leave analysis to psychiatrists, mediums, and readers. But it is sincerely suggested that some self-study and evaluation can help you get over some of those mountains and, at the same time, make your gas company even more able to accomplish its objectives.

J. Fred Ebsen

EDITOR

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GAS HIGHLIGHTS

Gas industry looks both North and South

While Canadian National Energy Board's hearings are going slower than expected, the U. S. gas industry is darting its eyes south as well as north. Both Canada and Mexico have gas—the U. S. has market. Pacific Lighting Corp., Texas Eastern and Tennessee Gas have been or are seriously interested in new natural gas production in Mexico. (Texas Eastern has been taking Mexican gas across the Rio Grande for some time.) And the efforts by several companies to import Canadian gas are well known. In Canada, Pacific Gas & Electric's spokesmen told Canada's NEB that Canadian gas plays an important part in their plans for California's future gas supplies.

Old timer passes out of the picture

The Everett, Mass. coke and gas manufacturing plant of Eastern Gas & Fuel Associates went into operation in 1898. Since that time it has supplied gas to Boston Gas Co., a subsidiary of EGAFA. Until 1953, it was Boston Gas' principal source of fuel. The availability of natural gas and the severe decline in the coke market make further operation of the plant uneconomic, so Everett will get a rest starting April 30, 1960. Boston Gas will change from mixed gas to straight natural in its central district in the period between April and August.

Producers win small victory

Gas (and oil) producers, with the help of some congressmen, have won a battle with the federal government. It is a small victory, but a victory on that field is unique.
Bureau of Mines and the Census Bureau proposed to require gas, oil, and other mineral industries to participate in lengthy annual surveys and turn the results over to the government. The industries fought this and, for a change, won.

Public utilities seizure still cloudy

The U. S. Supreme Court in a split decision refused to decide the constitutionality of state laws providing for seizure of public utilities in the event of strike. In question was one such law, Missouri's King-Thompson Act under which Laclede Gas Co. was seized by the governor in 1956 while the company was experiencing a strike. A six-man majority held that the strike was settled, hence the case need not be reviewed. Three judges dissented from the no-review ruling and wanted to study the matter to resolve the broader question.

Cold fails to hold Transwestern

While prolonged winter weather, cold rain, and the "flu" bug contributed to setting all-time high usage of natural gas in the Los Angeles Basin, Transwestern's new pipeline to bring additional gas to the area plowed through weather conditions said to be the severest in many years. Five mainline (30-in.) spreads, two lateral (24-in.) spreads, and four smaller diameter line spreads slogged it out through heavy snows and temperatures as low at 15 deg below zero. Transwestern is currently ahead of its construction schedule and building away on the most technically advanced and modern natural gas pipeline system ever physically started.

Part of Bastion Bay gas purchased by United

United Gas Pipe Line Corp. tied-up 1-trillion cu ft of natural gas reserves at big Bastion Bay field (south of New Orleans, La.). UGPL will pay 22.5 cents per Mcf for Gulf Oil and Tidewater Oil production. Several Gulf Coast based pipeline companies have made a pass or two at these large reserves. Their plans have covered movement of the gas to both coasts, and to areas between. Probably 3-trillion cu ft are still uncommitted. The UGPL-Gulf-Tidewater deal has to be approved by FPC —the price sets a new top for Gulf Coast gas.

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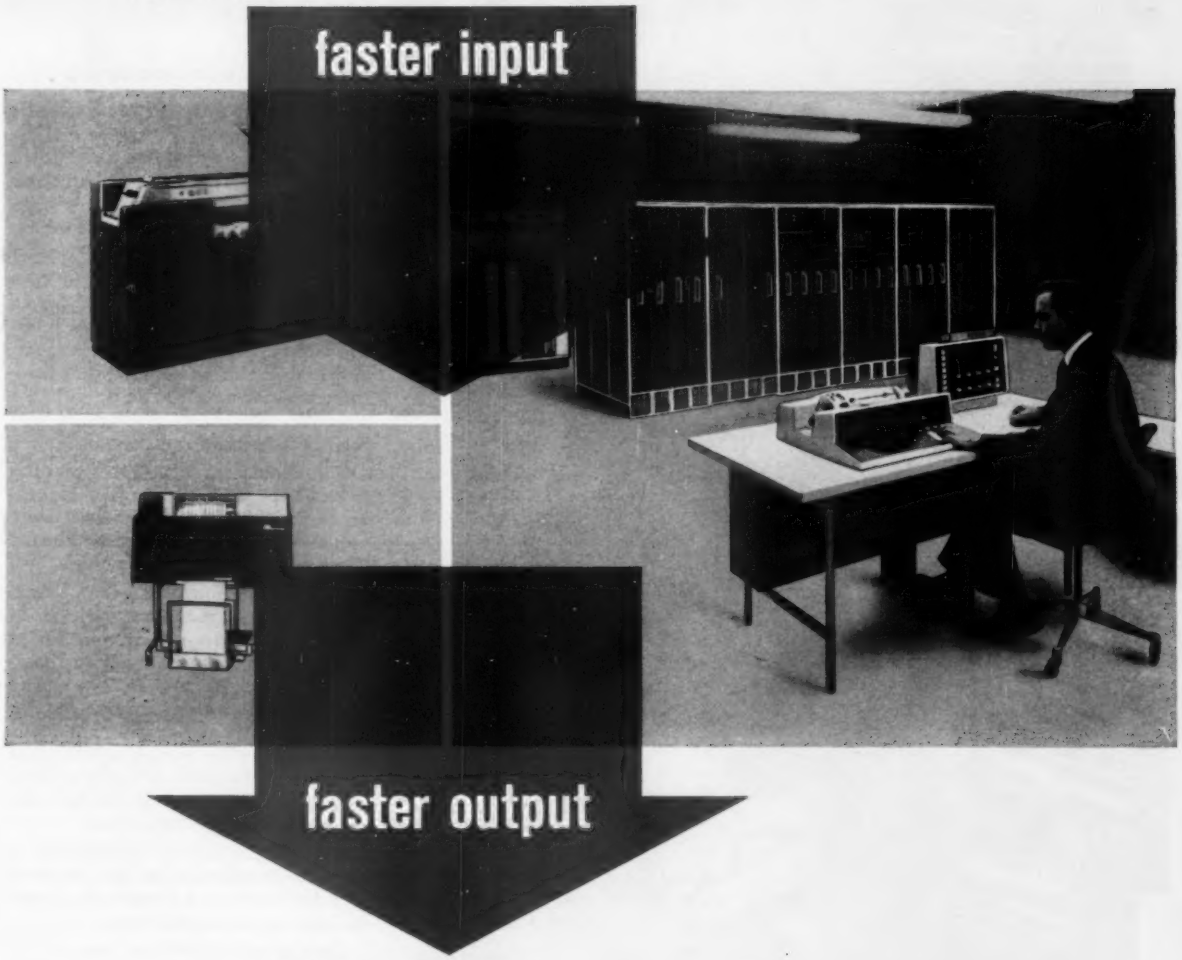

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Public interest prevails

THE Pennsylvania Public Utility Commission was affirmed by a court in its choice of one competitor over another to serve gas in a new area. The commission exercised its discretion in weighing the many phases of public interest to reach its decision, and the court found that there had been no abuse of discretion.

The commission said: "The Scranton-Spring Brook Water Service Co. has furnished convincing proof of its abilities to install, operate, and maintain adequate facilities for the purpose of furnishing gas service to the public in the areas covered by the applications. Indeed, a systematic record has been developed as to the company's experience, fitness, managerial organization, financial ability, and also, as to the economic feasibility and need for the service in this new territory. It is a locally owned and locally controlled corporation and there is a decided preference for its service by the municipalities and the residents in each of the municipalities involved in the contested areas."

The court can reverse the commission only if there is an error of law in the commission's order, lack of evidence to support the findings, or a violation of constitutional rights of the losing competitor to render utility service.

The controlling consideration in choosing one applicant over another to render utility service is the comparative public interest benefits. Of course, the one best fitted to serve the public convenience and necessity should win; and in the gas business safety jumps to the front along with dependable service at a reasonable price. The court asserted the correct standard to be the one in which the public interest is given paramount weight. The commission, said the court, must consider the interest of the public, as distinguished from the interest of the private corporation which is applying to extend gas service to new territory.

The court respected the expertise of the commission, and said concerning the choice of utility applicants:

"It is a question which must be left in a large degree to the sound judgment of the commission and when that judgment has been exercised upon competent and relevant evidence the conclusion ought not to be disturbed by judicial interference unless it is made clearly to appear that it is unreasonable and not in conformity with law."

The court reviewed the record to ascertain whether there was substantial evidence to support the commission's conclusions. The evidence revealed that the winning applicant was the larger operating utility in miles of gas main, number of customers and employees.

On economic feasibility the court declared:

"The record reveals that Scranton-Spring Brook presented to the commission a complete and sound plan to render service to all of the municipalities applied for. On the other hand, Pittston's exhibits were incomplete in certain respects. It had no exhibits showing the amount of gas contemplated to be consumed by users in Avoca, Duryea, Dupont, Exeter, and Ransom apart from its total requirements. These proceedings should be considered in their overall application to all of the municipalities applied for and should not be considered as to Exeter township alone. The commission considered that in order to make the entire project economically feasible, all the territory had to be awarded to the company offering the best plan for the public in all of the municipalities involved. For the commission to have reduced the territory awarded to Scranton - Spring Brook by the township of Exeter would have been a pro tanto reduction in the economic feasibility of the entire project."

The financial statements of the competing applicants showed that Scranton-Spring Brook had greater assets and smaller liabilities than the other company. In addition, Scranton-Spring Brook maintained a better balanced financial structure with only 57 per cent debt and 43 per cent equity, while the competitor was in debt 70 per cent and had a 30 per cent equity. Financial responsibility was given a high place on the climb up the ladder of regulatory approval.

The superiority of the successful applicant to serve gas was related, from the evidence, in the court's opinion thus:

"Scranton - Spring Brook has available for repair and emergency service superior equipment, such as a giant tapping machine capable of closing off or tapping pipelines from 6 in. to 12 in. in diameter and up to 500 lb in pressure without shutdown. It has an automatic electric power generating unit in the event of a power failure at its Uniondale station. It has a complete radio network with 24-hr operation, consisting of base stations and 2-way radio equipped cars and trucks. It has a telemetering hookup to enable gas dispatchers on 24-hr duty to know pressure and quantities of gas at all key points in the system. It has adopted the American Standard Code for Gas Transmission and Distribution System, under which it has installed duplicate regulators, safety relief valves, oil seals, check valves,

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"There is a decided preference for its services by the municipalities and the residents in each of the municipalities involved in the contested areas.

"Scranton-Spring Brook's managerial fitness and experience are superior to that if Pittston. Scranton-Spring Brook presented a plan which revealed the economic feasibility of supplying the contested areas. It estimated a return on its investment of 4.12 per cent on the entire project. Pittston presented no exhibit for all of the contested areas. It presented figures for the townships of Exeter and Ransom only.

. "Pittston never had a contract for a firm supply of gas from the Harveys Lake field. The Harveys Lake development by Transcontinental Production Co. was an exploratory venture and an effort to locate a new storage location. Pittston started taking gas from this source on Nov. 7, 1957. By Dec. 27, 1957, Pittston could not serve its existing territory, much less any new territory, with natural gas from Harveys Lake field. By Feb. 27, 1958, this source could supply only approximately 30 per cent of Pittston's existing gas requirements. Pittston's building of a pipeline at a cost in excess of $150,000 from a doubtful source of supply with no firm contract for supply of gas is alone sufficient reason to support the commission's finding in favor of Scranton-Spring Brook, particularly when the record shows that Scranton-Spring Brook's management pursued a sound, safe, logical policy in its efforts to bring service to the area.

"Scranton-Spring Brook has shown one hundred years of experience, unquestioned fitness, sound, logical management and extensive organization, financial ability, safeguards to the public, and dependability in rendering service."

If you would like to compete for new gas service areas, this case is a good example of the proof required for success in a comparative hearing before a public utility commission. And enlightened courts will sustain decisions of regulatory commissions that are based upon substantial evidence. ■

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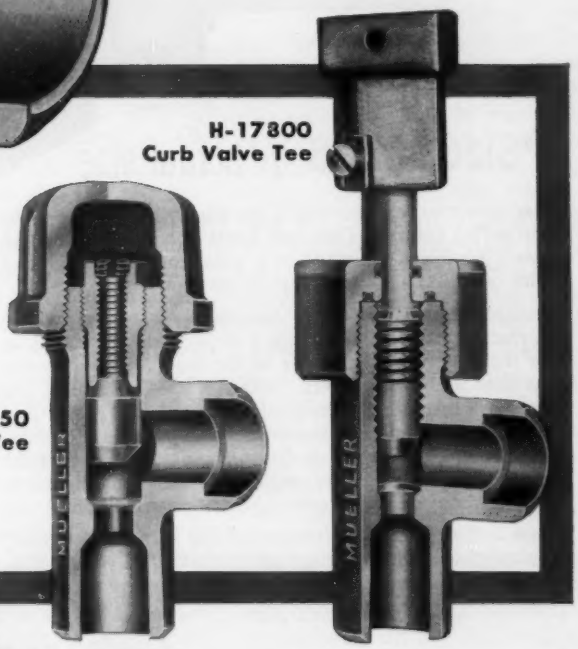

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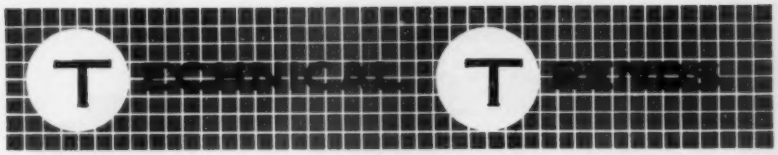

By GUY CORFIELD

The radiant gas burner

The traditional symbol of fuel gas combustion, the blue flame, is being challenged by the red-surfaced radiant gas burner often termed the infra red burner. This type of combustion is rapidly assuming importance in all fields of utilization—domestic, commercial and industrial. Domestic and commercial ranges use it for broiling and barbecuing. It is employed for space heating, in both small and large areas, and both indoors and outdoors. In industrial applications, huge ovens are designed for heat treating, paint drying, etc.

The radiant gas burner, as its name implies, emits a large percentage of the combustion heat of the gas as radiant energy. This is accomplished by having the combustion take place right at the burner face, which may be a porous or perforated refractory material, the pores or perforations being actually a large number of tiny burner ports. To make the gas burn right at these ports—or almost within them—rather than as protruding flames, the necessary air for combustion is pre-mixed with the gas as "primary air" and the flames do not have to reach out for "secondary air." In one type of burner the gas and air are power mixed, and in another the air is drawn in by and with the gas in a specially designed mixing tube and chamber. The result of this type of combustion is that the whole burner face becomes hot and visibly red, and radiates energy at wave lengths corresponding to its temperature.

In contrast, the blue flame produces very little radiant energy, its heat being utilized largely through conduction and convection from the combustion products. The yellow or non-aerated flame develops a little more radiant energy than the blue flame because of incandescent carbon particles in it which make it appear yellow. And some radiant energy can be produced by heating fireclay or metal "radiants" by the combustion products as is done in some space heaters and broilers and target burners.

The characteristics of radiant energy or radiant heat, that make it particularly applicable to many heating operations, is that the energy travels in straight lines across intervening space from the radiating source and converts into penetrating heat only when it strikes and is absorbed by a solid object. It can be directed, and will travel downward or sideways as readily as upward. Therefore, food can be cooked as easily from the top or side as from a bottom burner; spaces can be heated from overhead even outdoors because the heat energy waves will not scatter, or be blown away by wind; and large objects in an industrial furnace can be uniformly heated on all sides.

It was stated earlier that the radiant burners radiate energy with wave lengths corresponding to their temperature. The infra red or so-called heat waves coming from the typical radiant burner are principally in the wave length band from about 100 to 0.8 microns. This band is just below visible light which extends from red, 0.7 microns to violet, 0.4 microns. The rays from visibly red sources also produce heat, but not as much as those in the infra red region. The radiant burner usually peaks (has the greatest percentage of radiation) at wave lengths between 4 and 2 microns. But its total spread of temperature is wide enough to extend into the lower end of the visible region which is why the burner surface appears red. The red color is in a sense misleading, when it is considered that the bulk of the radiant heat emitted is at wave lengths too long to produce a sensation of light in the eye.

Saline water purification

Last year Congress authorized the construction of five different type demonstration plants for desalting or purification of sea water or brackish water—one each on the Gulf, Pacific and Atlantic coasts, and in the northern and southwestern interior. The locations and processes were to be designated and operations supervised by the Office of Saline Water of the Department of the Interior. Decision has been reached on two of these plants.

The first will be at Freeport, Texas, and will use the Badger vertical long tube multiple-effect distillation process. It will be of the evaporating type using a sudden drop in pressure, rather than heat, to boil off fresh water. Capacity will be designed for 1 million gal. per day. The site was chosen because of the proximity of Dow's magnesium-from-sea water plant. Water will be taken from Dow's intake line. Dow will furnish steam for the purification plant and, in turn, take the brine effluent into its plant. The City of Freeport, and Dow, will buy the fresh water.

The second plant is designated for Point Loma, San Diego, Calif. It will employ multi-stage flash distillation, with heat from a pressurized water nuclear reactor. In this process the salt water is heated and then introduced into a large chamber where a pressure just below the boiling point of the hot brine is maintained. As the brine enters this chamber the reduced pressure causes part of the liquid to flash into steam. The remaining brine is passed through a series of similar chambers at successively lower pressures where the flash process is progressively repeated. Incoming cold sea water will be used to condense the steam and recover heat. The fresh water will be purchased by the City of San Diego.

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By NEIL REGEIMBAL
GAS Washington Bureau

Two-phase fight facing industry

GAS industry supporters of decontrol legislation are this year like the unmarried and aging bridesmaid—ready and willing to mate, but with little to offer and almost no prospects.

Various segments of the gas bill support group are beginning to put together new gas bills and to try to force action on the shelved Harris-O'Hara measure.

At the same time, they're fighting coal industry efforts to win congressional approval of steps leading toward a national fuels policy—which they fear will be loaded to help the coal boys at the cost of expanding natural gas and oil sales.

In past years, they've been working from a position of strength in the gas bill, and been able to trade-off the coal-sought no-dumping amendment to their bill in exchange for no cuts in gas and oil depletion rates. The coal policy drive was in its infancy, and was then primarily aimed only at blocking these so-called off-peak, below cost sales of gas for industrial use.

If the Harris-O'Hara bill had been able to get through with this provision in it, there's a chance that the industry would not be facing the serious threat of a fuels policy.

But the bill didn't pass, largely because the pipelines generally were opposed to giving up this coal amendment, many producers believed it was too weak a compromise, and distributors were only lukewarm. In addition, the White House failed to press for the bill with any enthusiasm.

The Harris bill would replace present utility-type regulation with a commodity value system. It has again been supported this year by the Federal Power Commission, which says it is necessary to protect consumers, pipelines, and investors of "adequate long-term supplies of natural gas at prices which would be fair to all concerned."

Gas producers, through the Texas Independent Producers & Royalty Owners Association, and other groups, are circulating in producing areas as well as in Washington a much stronger bill — similar to measures attempted earlier and vetoed for a variety of better-to-be forgotten reasons.

It would remove from FPC jurisdiction prices charged by producers, thus eliminating all producer control, but retain control over the prices pipelines could pay. In considering the price a pipeline could pay, it would forbid FPC from using a cost or public utility cost-of-service basis in determining gas pricing exempt for gas produced by a pipeline.

And it would prohibit the FPC from decreasing a contract, but permit it to disapprove an entire contract and force new negotiations between pipeline and producer.

The producers will also consider other methods of firm decontrol before they make a push to have a substitute for the Harris bill introduced.

Producers say that they will press for action this year in spite of the extreme probability that they are butting their heads against a stone wall. Although the President was expected sometime early this year to again back the principle of lifting utility-type controls from producers, and the FPC would push for passage, it is virtually impossible that any substantial number of votes could be won for the measure among campaign-jittery congressmen.

Producers say they are fearful that if they don't get some favorable action this year, the FPC will go ahead with administratively imposed cost-of-service system, which they do not believe would solve the problems as decontrol would do.

Congressmen who support the gas industry made it clear as the new session got down to serious business in early February in cloakroom discussions that "we're sorry for the industry, but that's the way it's got to be this year."

Meanwhile, the early weeks of the new session brought black omens on the fuels policy front, as well. In less than three weeks after Congress convened, the House Interior Committee approved a bill to set up a new coal research office (with $2 million a year) in the Interior Department.

This would be similar to legislation vetoed last year by the President, except that it would not create a separate agency, as the earlier bill would have.

Purpose of the new office is to get government to help develop new methods of producing, marketing, and using coal, and coordinating research now conducted by coal companies and other private sources. The federal government thus would donate coal marketing ideas to the industry.

In addition, the fast-moving coal industry representatives are putting heavy pressure on Congress for approval of a companion bill. This measure would create a special

Continued on page 180

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Corrosion control on a major interstate natural gas transmission system

By PAT H. MILLER • Texas Eastern Transmission Corp., Shreveport

CORROSION control activities of a gas system can be carried on by a specialized corrosion department or by a general instrumentation department made up of various technical sections whose results basically depend upon instrumentation. Both systems are being successfully used.

Our experience, however, indicates that the second offers opportunity for greater economy and efficiency in overall company operations. Since the theory of all instrumentation is fundamentally related, we have found it possible to employ men with sufficiently versatile scientific training and mechanical aptitude to comprehend and successfully practice the techniques of instrumentation in its broadest sense. Given the appropriate human incentives, proper clarification of duties and responsibilities, and the appropriate tools and instruments, plus continuous training, such men can and will handle any combination of instrumentation problems, one as well as another. Diversification does not appear to reduce the efficiency of a really qualified instrument engineer.

On a long transmission system, a field engineer assigned to handle corrosion problems only must be assigned to a widely spread territory and a very large portion of the average working day is spent going to and from work locations. The accomplishments of this engineer can be increased when his activities are confined to a smaller area. Here his duties are diversified. He handles two or more activities such as corrosion control, gas measurement, quality control, and, possibly, communications in addition to servicing the instruments used by the other departments of the company. Such an arrangement permits the employee to work close to home. This results in better family life.

At the request of Eli R. Cunningham, vice president in charge of gas transmission operations, the measurement department of our gas transmission division operating department is, in effect, a general instrumentation department. In addition to being responsible for gas measurement, gas accounting, quality control, and corrosion control, we act as a general service unit maintaining pneumatic instruments and conducting tests for other departments. The effectiveness of this method of operation is reflected in the results of our corrosion control program: We run two complete corrosion surveys each year on every bit of our system—over 6000 miles of high pressure natural gas transmission lines and related structures. The same instrument engineers do all necessary trouble shooting on existing corrosion control facilities and supervise the installation of supplementary corrosion control facilities. In addition, they handle the gas measurement, pressure regulation, volume control, and miscellaneous pneumatic instrumentation work. The fact that each man's work is concentrated removes the need for driving appreciable distances between installations and prevents having similarly qualified technicians traveling the same area.

Needless to say, the broad knowledge and versatility of the engineers performing these duties enhances their qualifications for advancement.

History shows that on pipeline systems of this nature, leaks and blowouts in large numbers generally result where corrosion control is neglected. Costs of service interruptions due to leaks and blowouts, losses due to line leakage, and costs of line repairs have proven to be so great on individual lines not protected from corrosion that earnings were reduced.

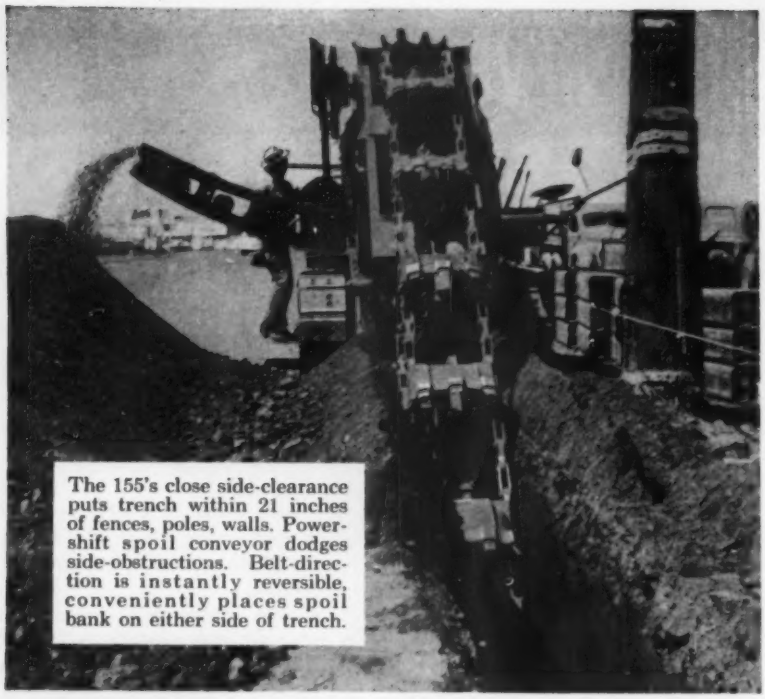
High pressure pipeline systems operated without the benefit of corrosion control are dangerous to workmen and public.

A company that suffers from excess number of leaks and blowouts is susceptible to damage suits, high insurance rates, rights-of-way trouble, poor public relations, and difficulty in financing.

It has been stated that a comprehensive corrosion control program dollarwise is the art of spending a few dollars to save many. A study of the leak records of systems operated during the days before corrosion control became more or less a standard policy shows that an average of as much as one major leak or blowout per year per mile of pipeline can be expected on unprotected high pressure natural gas systems after a very few years of operation.

The over-all cost on high pressure pipeline leaks varies from $50 to $1000 each, while the cost of blowouts might range from $1000 to $50,000. Assuming an

(*Continued on next page*)



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Puts trench within 21 inches of side-obstructions

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The 155 undercuts walks, curbs, and cross-pipes; also makes vertical set-ins to save hand digging and clean-up. Positive down-crowd boom starts cut fast, holds accurate grade.

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average over-all tangible and intangible cost of $500 for each leak or blowout, the profit from a corrosion control program costing $50 per year per mile of line would be considerable. Statistics show that major high pressure natural gas transmission systems with the larger portion of the lines coated can generally be protected for less than $50 per year per mile of line, including the protection of all related buried facilities such as compressor plants, etc.

Our purpose is to protect all operating facilities of the company from deterioration caused by corrosion and to apply corrosion control measures to all company facilities both above and below ground;

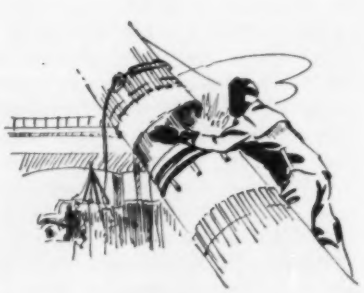
To apply such protection in sufficient time to avoid excessive maintenance costs, line losses, service interruptions, and intangible costs which result from pipeline failures due to corrosion;

To sell the merits of corrosion control to the pipeline maintenance crews and others in order to have their cooperation and assistance in carrying out the corrosion control program;

To teach the fundamentals of corrosion and corrosion control to all affected parties so that they may realize the importance of the program to the healthy growth of the company, and in turn, will lend assistance to the program;

To cooperate with other operating companies to avoid creating conditions which might cause corrosion to one another's facilities;

To keep other interested departments and the management informed as to work accomplished, the condition of the property in regard to corrosion, and in regard to the costs of the program. ■



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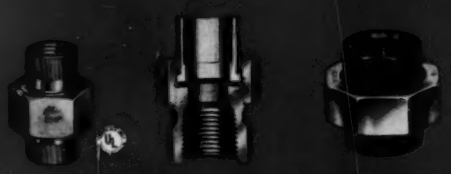

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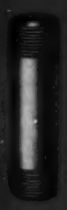

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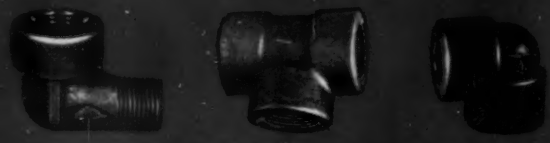

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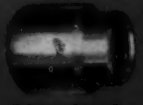

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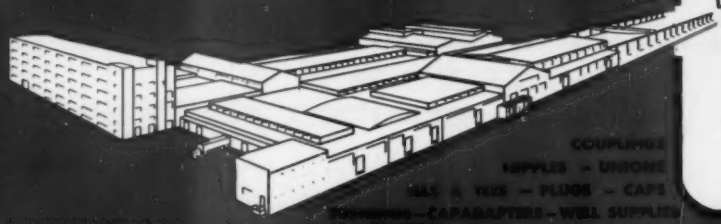

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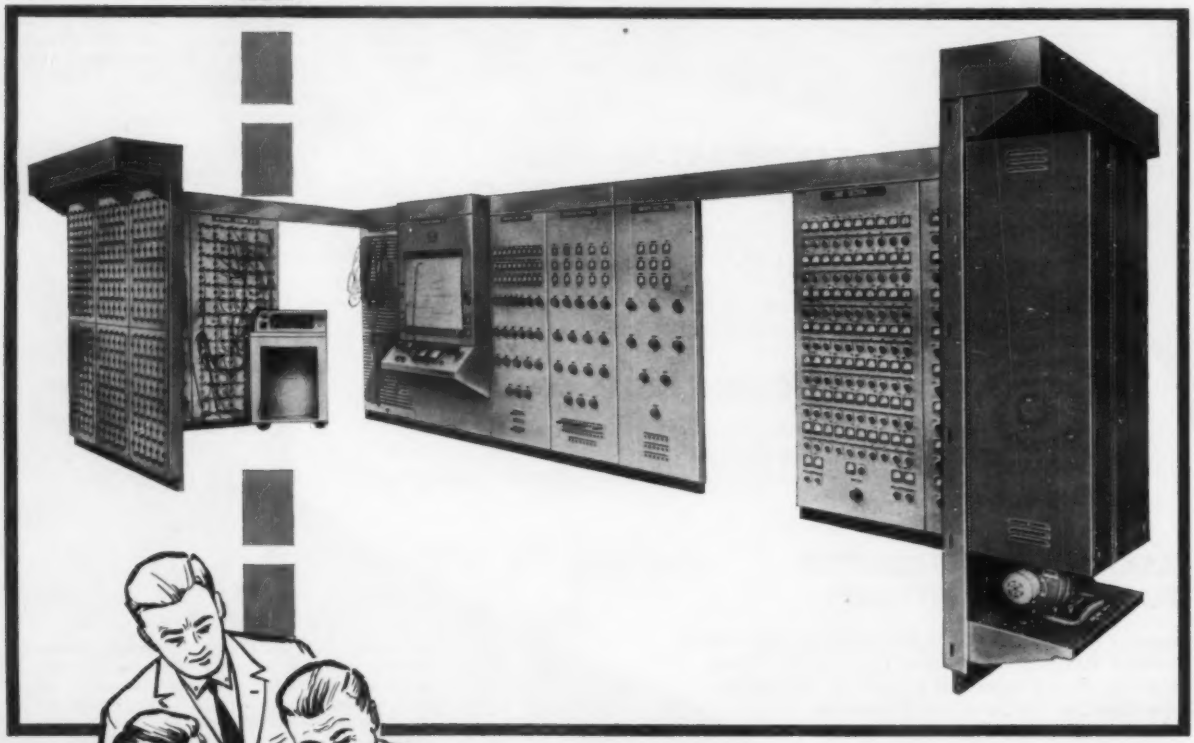

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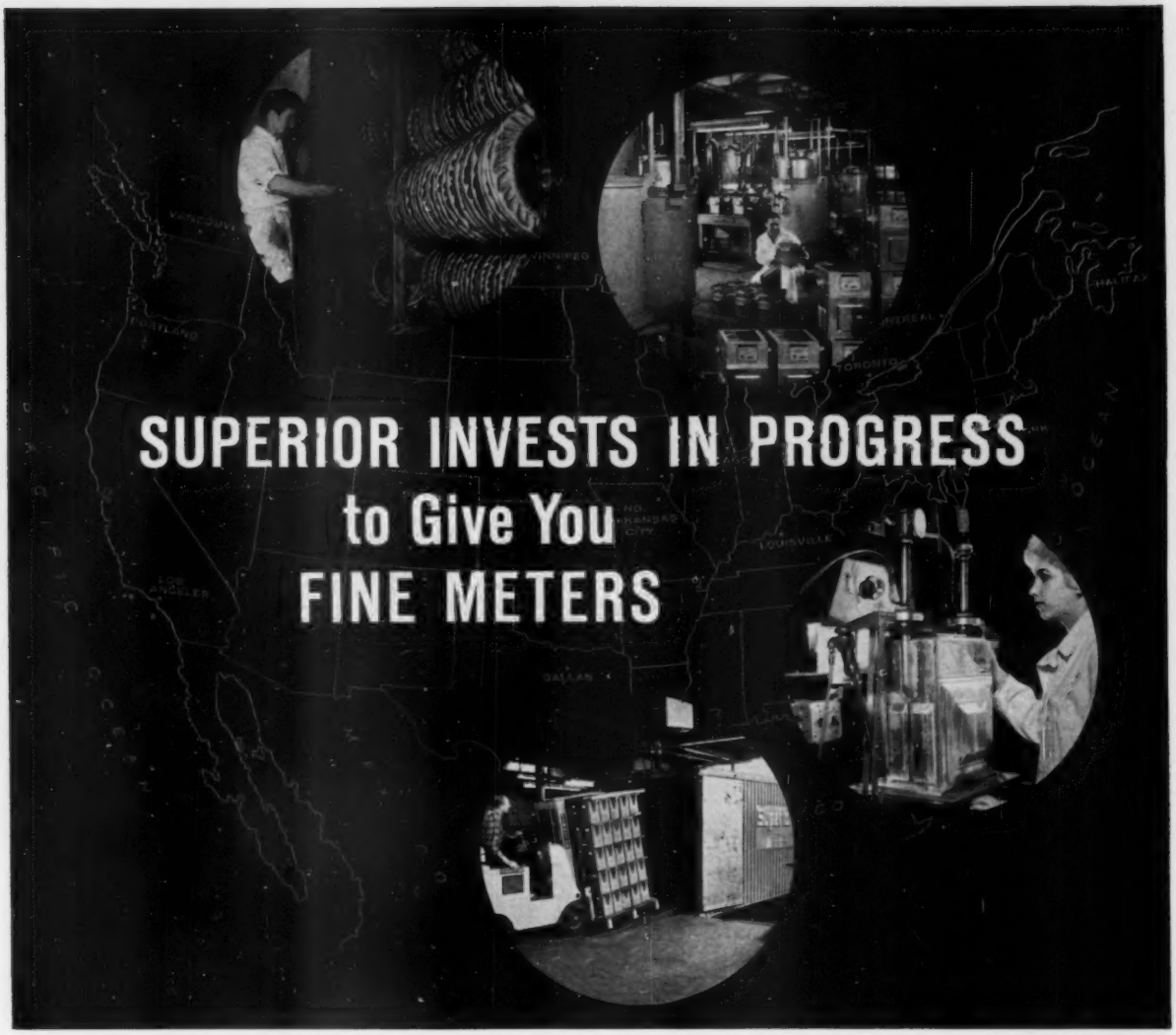

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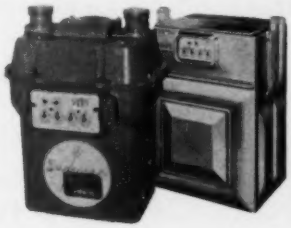

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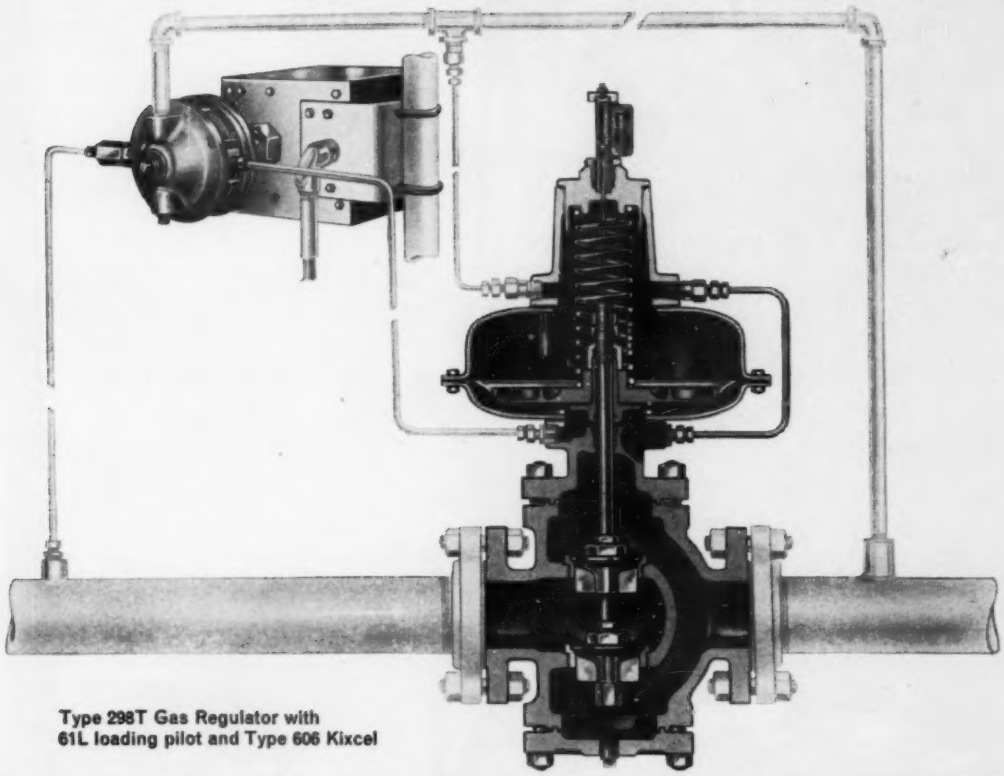
- High and low pressure limits can be set at any point throughout pilot spring range. (Pressure ranges from ¼ to 2 psi; 2 to 10 psi; 10 to 20 psi; 10 to 65 psi.) Also available for high pressure loading pilots up to 300 psi.
- Quick, easy manual adjustments without changing pressure limit settings.
- Various gear ratios available for different rates of pressure change settings.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .



Type 298T Gas Regulator with
61L loading pilot and Type 606 Kixcel

606 KIXCEL

Once again Fisher engineering steps in to help the Gas Man provide better service to his customers at the same time achieving greater efficiency at the distribution station.

With fingertip control the Kixcel Type 606 raises or lowers the pressure set-point of the Fisher Type 298T loading pilots even though the central control station is miles away from the regulator station. Kixcel Type 606 is also available for other Fisher pilot operated regulators.

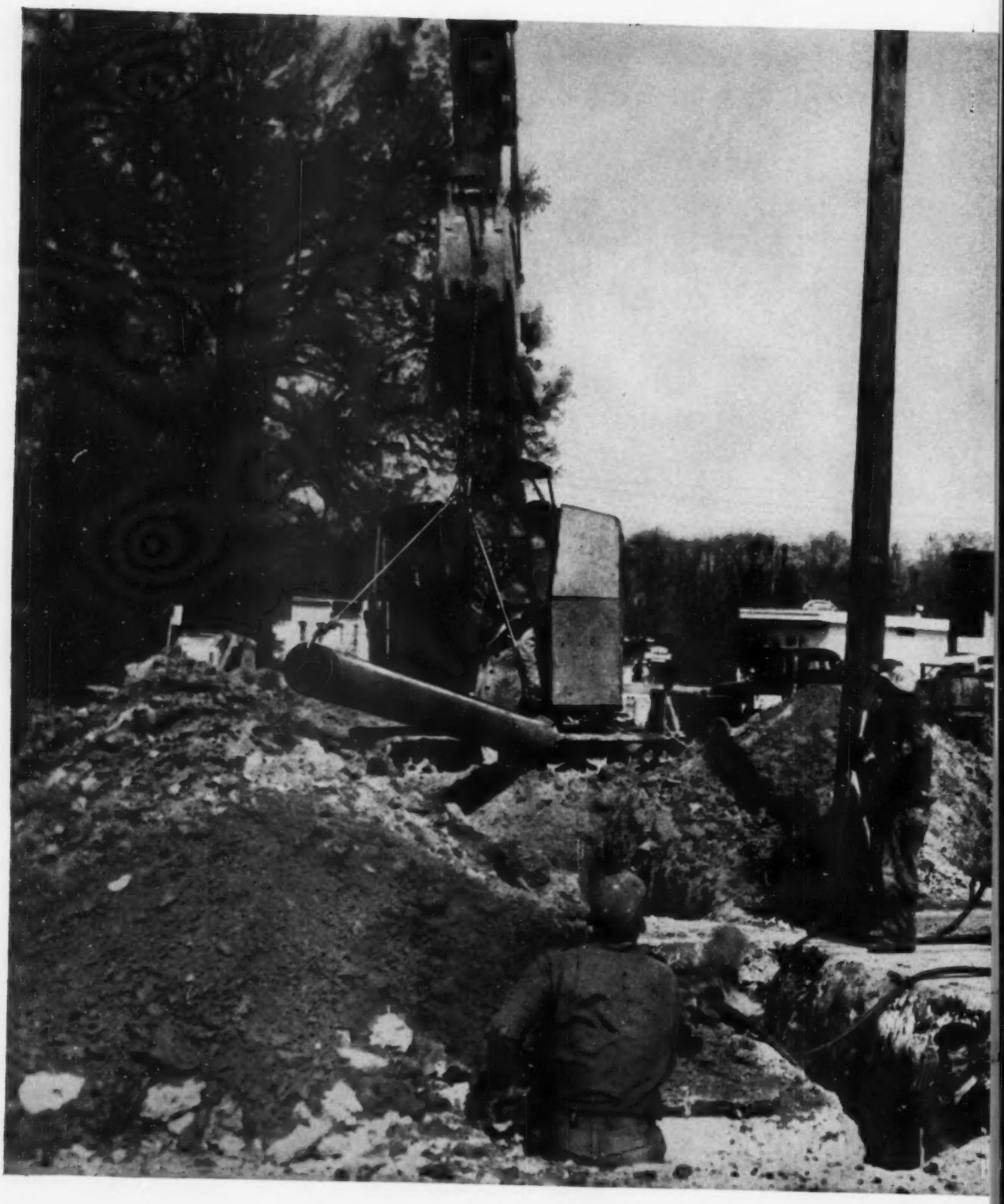
The operator's commands are transmitted by either conventional telemetering control or by a polarized DC signal sent over a pair of telephone wires.

The Kixcel Type 606 is encased in a rugged, weather-proof cover and will withstand all outdoor temperatures.

Write for complete details.

FISHER® Controls
SINCE 1880

FISHER GOVERNOR COMPANY
Marshalltown, Iowa / Woodstock, Ontario / London, England
BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT CO., CORAOPOLIS, PENNSYLVANIA



THE MARK OF THE 100-YEAR PIPE

IF YOUR DECISION MUST STAND UP FOR 100 YEARS...

Will your decision today help determine your utility's gas system for the next century? Consider the case for cast iron pipe:

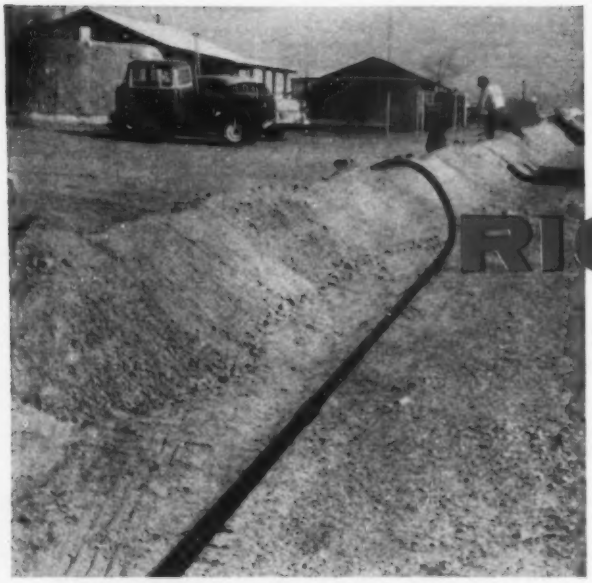
- Sixty-two American cities have had cast iron pipe gas mains in constant service for over a century.
- Rugged, corrosion-resistant cast iron pipe rarely needs repair once it's installed.
- Modern mechanical joints remain tight under normal distribution pressures.
- Cast iron pipe withstands all the usual stresses to which underground pipe is normally subjected.
- Easier to install—cast iron pipe comes in convenient lengths, ideal for congested underground installations.

Cast iron pipe's ruggedness . . . durability . . . and practically maintenance-free operation make for real savings over the years, too!

CAST IRON PIPE RESEARCH ASSOCIATION
Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois

. . . good reasons for <u>you</u> to choose

CAST IRON PIPE



Ten 20-ft. lengths of rigid pipe after being coupled. Two workmen did this job in only 20 minutes!

Workmen joining two sections of 1¼" rigid pipe.

ARIZONA PUBLIC SERVICE COMPANY SAVES 50% WITH RIGID PIPE

made of ABS Plastic

RIGID PIPE GAS SYSTEM INSTALLATION OFFERS NEW PROOF OF SUPERIORITY OVER CONVENTIONAL TYPE

Big news for happy housewives in Gila Bend, Arizona—the convenience of gas utility service for the first time! Important news for utility companies everywhere—the 50% savings over cost of conventional pipe gained by use of Anesite rigid ABS pipe made of CYCOLAC throughout the system! Saved precious man-hours, too! Arizona Public Service Company completed the job in record time . . . insured a failure-free system with this lightweight, leak-proof, AGA-approved pipe. Another example of better service . . . bigger savings from rigid plastic pipe in vital municipal installations!

BE *ABSolutely* SURE . . .
INSIST ON RIGID ABS PIPE
made of
CYCOLAC®
THE BORG-WARNER PLASTIC THAT IS TOUGH, HARD AND CORROSION-RESISTANT

Write for the name of your nearest supplier

MARBON CHEMICAL
WASHINGTON

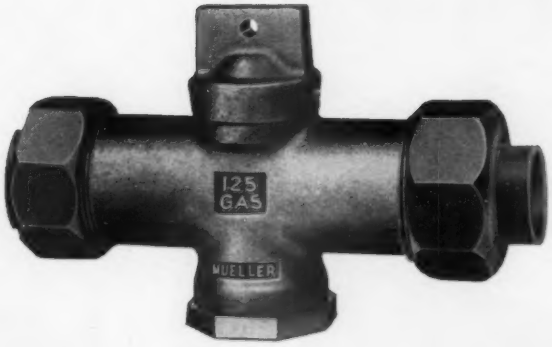
MARBON CHEMICAL
BW
BORG-WARNER

DIVISION **BORG-WARNER**
WEST VIRGINIA

reduce corrosion

...use MUELLER

Tees and Curb Stops with insulating couplings

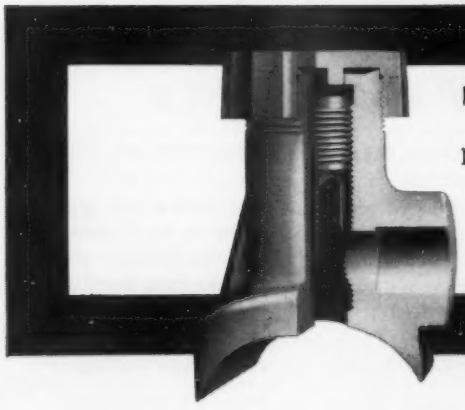


Mueller Tees and Curb Stops with insulating couplings effectively insulate the service line at the main and at the curb. This permits the use of dissimilar metals, such as copper service pipe, with a steel main. Electrical bond is broken at convenient points and corrosion is reduced.

Check corrosion in existing systems by replacing present curb stops with Mueller Cutting-In Curb Stops which have insulating couplings.

Mueller Tees and Curb Stops with compression couplings for steel pipe can be converted to insulating couplings for copper pipe by using a Mueller Insulating Adapter Gasket.

This detail of design greatly simplifies the ordering and inventory of tees and stops. It is typical, however, of the attention to detail in research, design and engineering that becomes a part of every Mueller product produced for the gas industry.



MUELLER PLASTIC TEES

. . . permit fast, safe service connections to plastic pipe. Tee is solvent-welded to main and service line. Main is then drilled under pressure by rotating built-in cutter. Cutter retains coupon and backseats against "O" ring in top of tee to prevent leakage. The tee includes a valve for future shut-off.

GEM

NO-BLO

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

You get a full measure of value with a Holan Gas Meter Body

Versatility is one measurement of value—and on that score the Holan 75-C Gas Meter Body really measures up.

The 75-C is built for gas meter installation—but it is ideal for delivery and installation of appliances and general service work.

Six 10-light meters ride in cushioned safety to the job. Two are stored in the left-hand vertical compartment; four are carried inside the body on a sturdy meter platform.

Like other Holan bodies, the 75-C has flush-type door handles with key locks and safety-tread steel floor.

Tubing, connections, conduit and miscellaneous parts and equipment are carried in vertical and horizontal compartments. Optional lower rear compartments are available on either or both sides.

Long lengths of pipe can be carried in the pipe rack, held securely in place with hold down clamps. A rear-mounted pipe vise bracket and folding pipe support at front make easy work of on-the-job cutting and threading.

Your Holan Field Representative would be happy to supply more details... or write us for literature.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

Naugatuck KRALASTIC

Underground corrosion steals $600,000,000 a year!* but KRALASTIC ABS pipe can't corrode

It can't rust or rot—is free from electrolytic action—impervious to water and the usual soil elements—highly resistant to most chemicals. Pipe made of KRALASTIC®, the original ABS rubber-resin, never needs coating, lining or anode protection.

What's more, amazingly tough KRALASTIC pipe gives a host of other advantages over conventional pipe materials.

- KRALASTIC pipe is extremely lightweight—needs no heavy handling equipment or costly bedding.
- It can be snaked through many existing lines—eliminates much time- and money-wasting ditching.
- It offers extremely low internal friction—will not accumulate scale.
- It can be quickly and easily solvent welded—by relatively unskilled workers. Or it may be threaded and used with threaded fittings.
- KRALASTIC has outstanding impact strength—even at arctic temperatures.

In short, KRALASTIC is a noncorroding pipe material with a combination of properties no other pipe material can match.

Proof of KRALASTIC pipe performance? More than 9,000 miles of KRALASTIC pipe have been specified, installed and are now in trouble-free service carrying potable water, brine, gas, a wide variety of chemicals and even electrical wire and cable. KRALASTIC pipe has been approved by the National Sanitation Foundation and is already accepted in many local plumbing codes.

Better look into KRALASTIC, the original ABS, today. Simply write on your letterhead to the address below.

*Estimate of the National Bureau of Standards

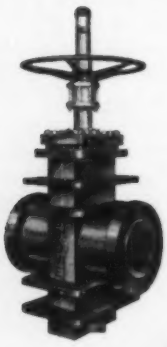
United States Rubber
Naugatuck Chemical Division
314K ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

IN CASE OF ANY EMERGENCY

HERE'S THE VALVE YOU KNOW WILL WORK



This is a rugged, dependable valve you can forget until you really need it. When you do—it'll work. There's no wedging to cause wear and jamming. The polished gate slides easily and quickly between smooth metal seats and rugged "O" rings. Exclusive Grove design lets gate and seats float free—eliminates distorting effects of pipe-line strain, internal pressure and temperature. Requires as many as 250 less turns to close than some competitive valves, too.

And, there's no lubricant to forget or to be washed away. Tough, flexible "O" rings are always there when you need them to give a bubble tight seal every time.

The next time you need valves, call your Grove man. He has the valves you can really depend on.

GROVE VALVE and REGULATOR COMPANY

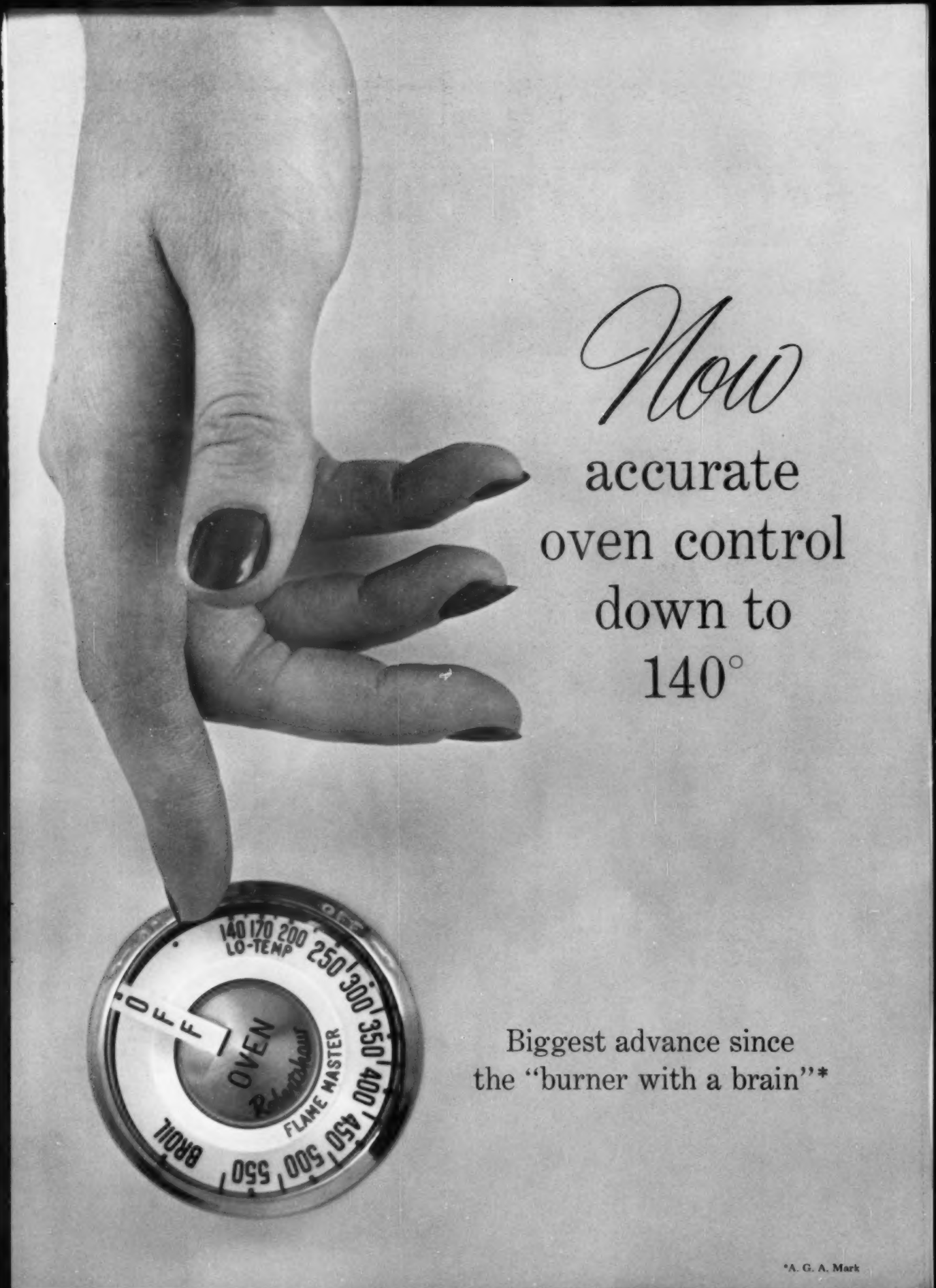
65th & Hollis Street, OAKLAND 8, California

HOUSTON 27—3203 Mercer St. • LOS ANGELES 6—2559 W. Olympic Blvd.

ODESSA • TULSA • DENVER • CHICAGO • NEW YORK • DALLAS • PITTSBURGH

FARMINGTON, N. M. • LAFAYETTE, LA. • HARVEY, LA. • LONGVIEW, TEXAS

In Western Canada: GROVE VALVE LTD., EDMONTON


Now
accurate
oven control
down to
140°
140 170 200
LO-TEMP
250 300 350 400 450 500 550 BROIL
OFF
OVEN
Robertshaw
FLAME MASTER
Biggest advance since
the "burner with a brain"*
*A. G. A. Mark

NEW TYPE OVEN CONTROL

FLAME

Here's the
new type
oven control
that will...

convert "lookers" into buyers!

A MANUAL ON THE U

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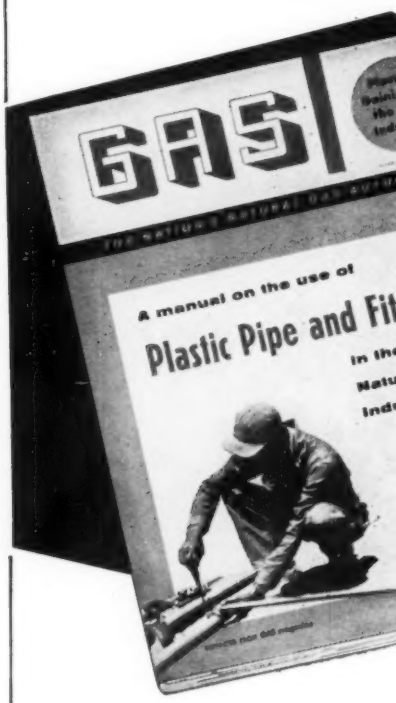
in the



This manual provides a weal
tion invaluable to gas distri
plastics pipe applications.

It traces the development and
in the gas industry, details t
ance of these piping mate
describes both routine and u
panies are making of plastics

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Send me ..... copies of Plastic Pi

NAME .....

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USE OF

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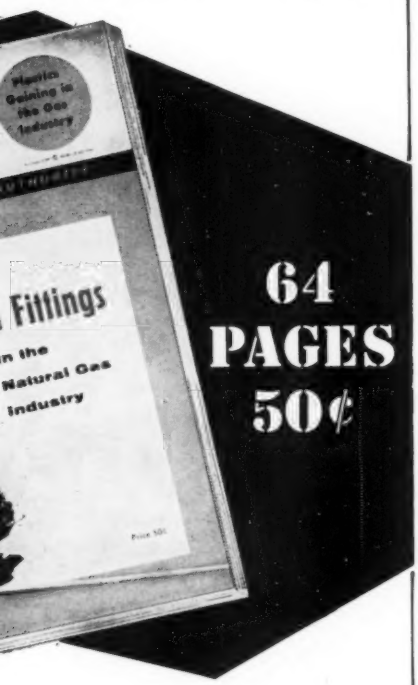
he Natural Gas Industry



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wealth of background informa-
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and progress of plastics piping
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naterials in gas systems, and
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TION'S NATURAL GAS AUTHORITY
98 S. Alvarado St., Los Angeles 57, Calif.

ic Pipe and Fittings. Payment enclosed.

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.....ZONE .....STATE .....

MASTER

NOW, a roast, even the entire meal can be cooked ready-to-serve ... hours before serving time!

No drying out ... No w-i-d-e temperature swings

NOW, the homemaker can complete cooking ... hours before serving time. She can delay serving for hours ... warm dishes ... and thaw frozen foods in her new gas oven!

She can enjoy all these advantages by simply turning the new FLAME MASTER* gas oven control dial to the LO-TEMP area ... down to 140°!

This new FLAME MASTER oven control will convert "lookers" into buyers and here's why — this biggest advance since the "burner with a brain" will soon be the *most-wanted* feature in new ranges and built-ins.

No w-i-d-e temperature swings. Of all oven controls, only the FLAME MASTER *accurately* controls temperatures from 550° *down to 140°*! Available only in gas ranges, it's a Robertshaw feature that can't be duplicated.

The new "no-button" automatic oven pilot, a part of this FLAME MASTER oven control system, gives you another sales clincher. If the pilot goes out for any reason, the homemaker simply holds a lighted match to it! There's no button to push and hold in, no string to pull, no waiting for a service man.

Write today for literature. Homemakers will be asking about the FLAME MASTER—the new gas oven control with *accurate* LO-TEMP settings! Robertshaw Thermostat Division, Robertshaw-Fulton Controls Company, Youngwood, Pa.

VMA 6782

*Trade Mark

Reprints of this ad will soon be mailed to leading gas appliance dealers

Robertshaw

MR. CONTROLS

Showers

Dresses

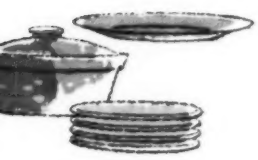
Relaxes with
Her Family

Entertains
Her Guests

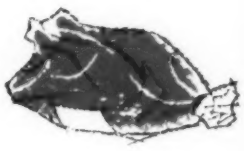
Since the completely cooked roast and the entire dinner can be held for hours at serving temperature, the homemaker is no longer ruled by the kitchen clock.

Ready-to-Serve Meals Can Be
Delayed . . . for Hours

Now, that the ready-to-serve roast and dinner can be delayed for hours, there's no cause for worry if father or guests are late!



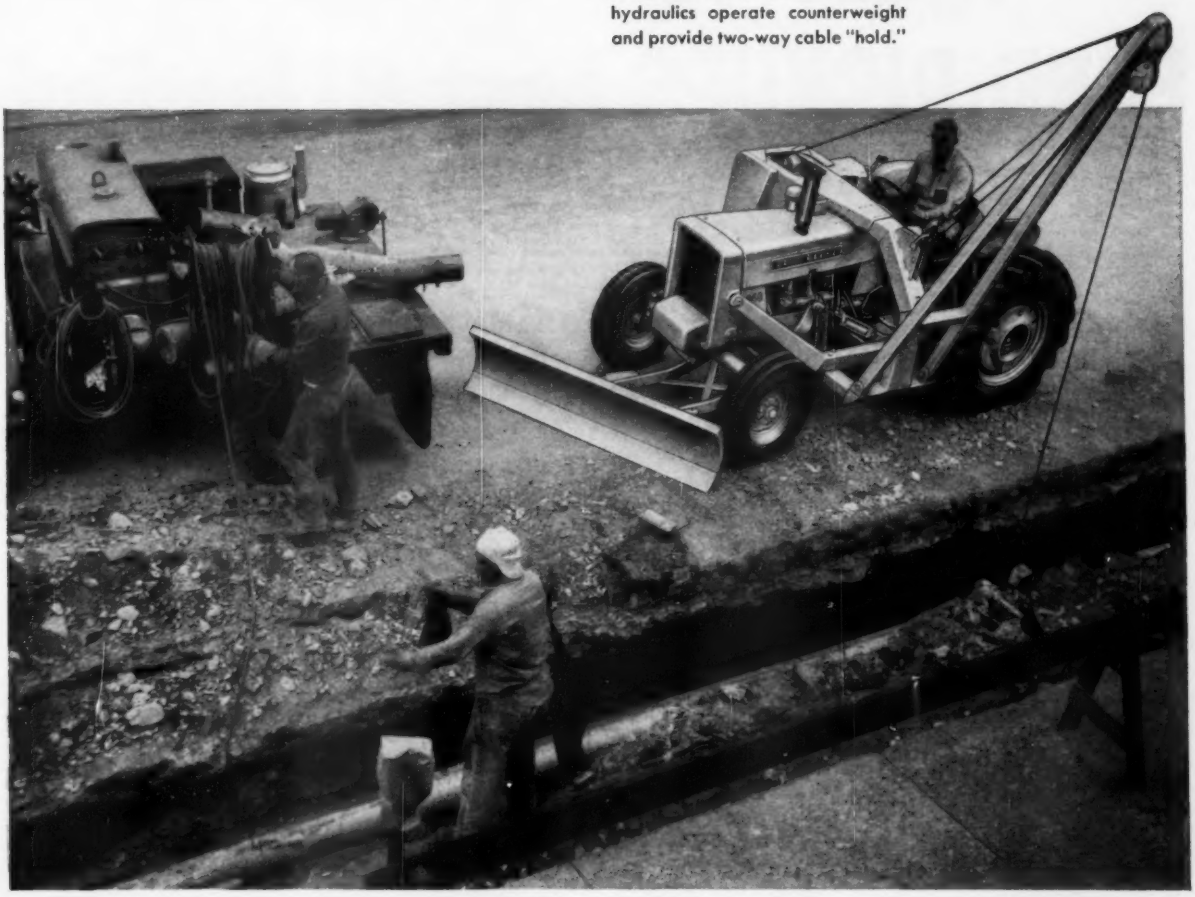
Warm
Dishes



Thaw
Frozen Foods

And now the homemaker can use her gas oven for warming dishes and for faster thawing of frozen foods. Example: a 7-lb. turkey can be thawed in about 2½ hours vs. 28 hours in a refrigerator or 14 hours at room temperature!

Sideboom operation is all-hydraulic: line winch and boom winch are powered by hydraulic motors; hydraulics operate counterweight and provide two-way cable "hold."



John Deere Sideboom helps beat high cost of distribution work

Low in cost, the compact John Deere 300 Sideboom speeds construction of mains, feeders and services by providing sure, smooth unloading and laying of pipe, backfilling, and, with pipe-bending attachment, bending pipe up to eight inches in diameter.

Size of the unit is ideal for work in congested city streets, and power steering provides the easy handling needed for fast, efficient work. Both wheel and crawler units are available, with gasoline or Diesel power.

For detailed specifications, contact your John Deere Dealer through the classified section of your telephone directory or write direct today.

SPECIFICATIONS

Length of Boom: 10 feet
Over-All Width: 75 inches
Over-All Height: 11 feet, 8 inches
Rated Lift Capacity:*
4 feet from boom pivot—
3,000 pounds
10 feet from boom pivot—
1,200 pounds
*With 78-inch bulldozer blade down and right rear tractor wheel ballasted. Capacity higher for crawlers.

John Deere Industrial Division, 3300 River Drive, Moline, Illinois

JOHN DEERE *"Specialists in Low-Cost Power with a Heavyweight Punch"*

Again in '60

FORD PICKUPS beat all leading

New and certified proof that Ford

Ford Six delivers 13.1% better gas mileage in second running of Economy Showdown U.S.A., conducted by America's leading independent automotive research organization. Standard 1960 ½-ton pickups of the five leading makes were purchased from dealers just as you would and tested for over-all gas economy. The trucks were run both empty and loaded, over flat terrain and hills, at low and high speeds, and under city traffic and retail delivery conditions.

Certified results show the Ford Six won *every* test—with marked superiority in the tests covering city traffic and retail delivery conditions. The combined Ford advantage for all the tests was 13.1% more mpg over the average of all the other makes tested. In fact, the Ford Six beat one competitive pickup by a whopping 27%.

The 1960 Fords not only deliver the best gas mileage of the leading makes – but they do it without sacrificing any of the performance characteristics for which Ford is famous. Ford's highly efficient carburetion system meters fuel more precisely at both low and high speeds, providing the right balance between power and fuel consumption for the best economy of operation in all kinds of driving.

And that's not all . . .

makes in Gasoline Economy!

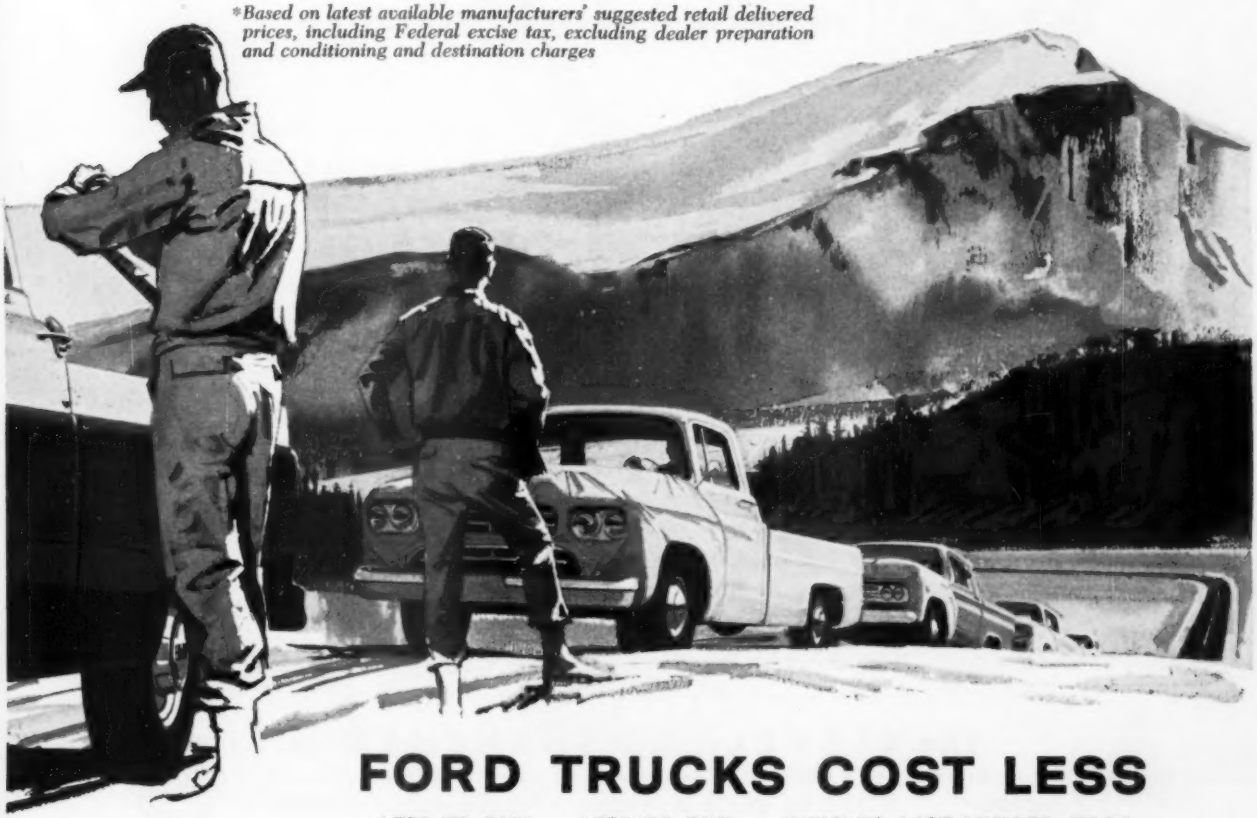
Trucks give you greatest gas savings

Ford gives twice the tire life with proven truck-type front suspension. Ford's solid front axle and leaf spring suspension system maintain constant front wheel alignment better than the "soft-type" independent suspension used on some 1960 trucks. Certified results of tests conducted to determine the tire wear of equally loaded trucks with the two types of suspension showed that, under average operating conditions, the independent suspension wears out front tires twice as fast. And the difference in tire wear can save you as much as $300 over the life of a pickup.

Ford is priced below all other leading makes!* New 1960 Ford ½-tonners are priced from $33 to $181 below those of leading competitive makes. Two Tone paint, power steering, wrap-around rear window plus many other desirable options also cost you less in a Ford. And, if you need a larger pickup a check of the suggested list prices will show Ford's prices for ¾- and 1-tonners to be the lowest of them all.

Ford offers Certified Proof! Yes, this year, if you buy a Ford instead of a competitive truck, you can be sure to save—Ford's economy is certified! Check the certified records yourself in your Ford Dealer's "Certified Economy Reports" . . . see and drive the new Ford Trucks . . . check the price tags . . . *and you'll save for sure!*

**Based on latest available manufacturers' suggested retail delivered prices, including Federal excise tax, excluding dealer preparation and conditioning and destination charges*



FORD TRUCKS COST LESS

LESS TO BUY . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

There's nothing like a Cleveland J-20 for distribution trenching

- only 60" wide over its crawlers.
- hydraulically shifted conveyor.
- pulley-enclosed dual conveyor drive.
- operator controls conveyor speed and direction.
- digs 12"—24" wide, 5½' deep.
- 4 forward wheel speeds plus reverse.
- 33 positive digging speeds.
- *all* speeds in both directions.
- world's finest trencher crawlers.
- 1,000-hour track lubrication.
- full-range boom hoist.
- 330 cu. in. engine, 50 HP @ only 1250 RPM.
- hydraulic-lift crumbing shoe, optional.
- 100% control at operator location.

DIGS MORE JOBS...
IN MORE PLACES...
AT LESS COST

- works in tightest quarters.
- sneaks by poles, trees, etc.
- trenches 18" from side clearance.
- digs services as well as main extensions.
- digs all soils—hard, loose, wet, dry.
- truck-loads on shallow, excess-spoil cuts.
- conveyor capacity for deep sloped trench.
- easy on lawns, sidewalks, blacktop.
- digs trench clean, to precise grade and width.
- reliable production in all job conditions.
- simplifies job-scheduling.

Check with your distributor now...get the complete J-20 story

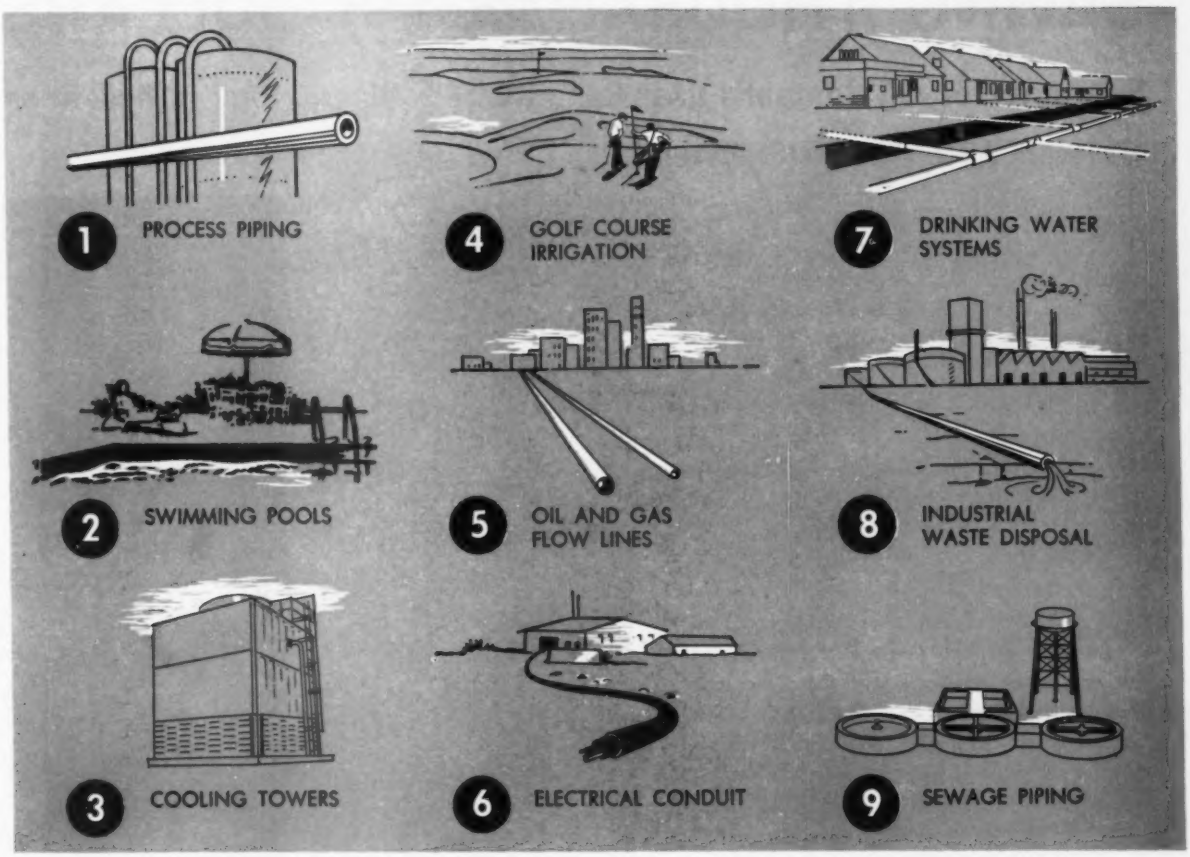
Good Everywhere

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

GEM

PLASTIC PIPE *Check List*



Specify YARDLEY for engineered applications

Yardley, one of the largest and oldest producers of plastic pipe, offers both flexible and semi-rigid pipe especially engineered for plumbing and air conditioning applications.

This advanced line of pipe is available in a variety of materials including normal and high-density polyethylene, Kralastic,® rigid PVC, styrene copolymer and other special formulations. Sizes from ½ inch through 10 inches in diameter with pressure ratings up to 200 psi. at 74°F . . . a complete line of precision fittings for every requirement.

Yardley pipe is distributed nationally, supplied from 11 completely stocked warehouses, assuring immediate delivery to any point in the country. For complete technical data and specifications, mail the coupon today.

YARDLEY

YARDLEY PLASTICS CO.
142 Parsons Ave., Columbus 15, Ohio

YARDLEY PLASTICS CO.
142 Parsons Ave., Columbus 15, Ohio

Send me a copy of Catalog 2000 which contains specifications and data on Yardley Pipe

NAME_____

FIRM_____

TITLE_____

ADDRESS_____

CITY_____ STATE_____

SAVING THOUSANDS OF DOLLARS

R.S.Anderson Oil Company uses Republic SRK Plastic Pipe in flow lines and salt water disposal systems

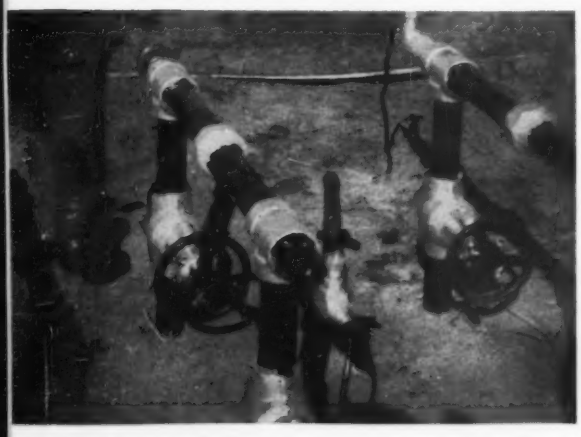
With more than 15,000 feet of Republic SRK® in service, the R. S. Anderson Oil Company, Midland, Texas, is no stranger to plastic pipe.

Anderson has been using SRK Plastic Pipe to handle sour crude for more than three years. In lines previously replaced every six to eight months, SRK is still in service. Anderson reports no corrosion, no evidence of chemical action in general, and very little damage from abrasion. Savings—already estimated at 50%—grow with every added day of service.

The key to these savings, according to Anderson, is *good* plastic pipe. In the manufacture of SRK, Republic starts with the finest raw materials, follows through with the best equipment and techniques, finishes only after *every length* of pipe has been thoroughly inspected.

SRK is available in a wide range of pressure ratings and sizes from ½″ through 8″. For further information, get in touch with your nearest Republic distributor. Or, clip and mail the coupon at right.

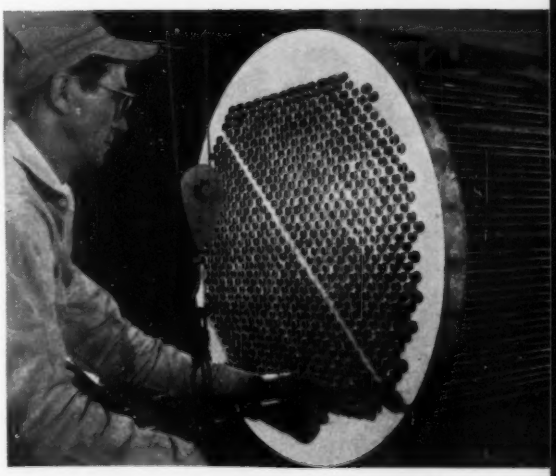
The pipe seen is 2″ Republic SRK (semi-rigid type) rated at 150-lb. It is being installed in the Anderson Company's Westbrook field by the San Andress Construction Company, Snyder, Texas.



REPUBLIC COLD FINISHED ALLOY BARS are used by the S. M. Jones Company, Division of Buffalo Eclipse Corp., Toledo, Ohio, in the production of Sucker Rod Couplings which must withstand static and dynamic loads of up to 40,000 psi. Republic Alloy Steels provide an outstanding combination of qualities which permit the use of smaller, lighter cross sections. Send for data.

REPUBLIC NYLOK® BOLTS AND NUTS produce a strong, metal-to-metal lock, whether or not fastener is seated. In use, nylon pellet imbedded in body of fastener is deformed, setting up a permanent lateral thrust. NYLOK Fasteners are fully adjustable and re-usable. Return the coupon for complete information.

REPUBLIC ELECTRUNITE® HEAT EXCHANGER TUBES are formed from highest quality flat-rolled carbon or stainless steel. Welded without the addition of foreign metal. FARROWTEST®—a proved production safeguard—detects and rejects tubing with defects of critical size. Offered as an alternate to other less positive tests at no extra cost. Mail coupon for complete information.



REPUBLIC STEEL

REPUBLIC STEEL

Steel Pioneer in Plastic Tubular Products

REPUBLIC STEEL CORPORATION
DEPT. GS -9083
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

- ☐ SRK Plastic Pipe
- ☐ ELECTRUNITE Heat Exchanger Tubes
- ☐ NYLOK Bolts and Nuts
- ☐ Cold Finished Alloy Bars

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Model 772 digs to 5'6" depth in cutting widths from 10-24". Model 773 is identical except for wider track gauge pad widths.

BARBER-GREENES YOU A 25-100%

The big difference: Hydra-Crowd transmission that lets you instantly dial maximum crowding speed for any ground condition

Barber-Greene wheel ditchers obsolete all others digging to 5'6" and 7' depths by out-producing them from 25 to 100% every day. And your Barber-Greene delivers a peak production pay-off in: 1) variable ground conditions; 2) frost, caliche, and hard pan-type; and 3) sticky gumbo-type digging.

Exclusive dual-range Hydra-Crowd transmission makes the big difference, enabling your operator to dial *instantly* the maximum crowding speed for any ground condition, or reverse *instantly*, too. He selects from *infinitely variable* crowding speeds *independent* of wheel and conveyor drive. No four-operation gear shifting. No guessing about gear ranges. No stopping to change speeds.

More Barber-Greene exclusives that contribute to precision performance with lowest cost of operation include:

- Flexible drawbar between chassis and boom continually absorbs digging shocks, reduces transfer of twist and tilt from wheel to chassis when digging curves or over uneven ground.
- All-hydraulic spoil conveyor independent of wheel speeds for instant selection of infinitely variable speeds—instant reverse.
- Hydraulic controls give greatest accuracy in digging to line and grade.
- Crawlers are easily adjusted in one-tenth the time of ordinary crawlers.
- Automatic overload guard, hydraulic brakes and hydraulic wheel hoist protect both man and machine.

Call your Barber-Greene distributor for your on-job demonstration. You'll get proof why you can't afford to dig ditch with any other machine.

Model 774 shown with standard 5'6" depth, 30" width wheel. Optional model digs to 7' depth.

WHEEL AND DEAL DITCHING BONUS

MODEL 774—INDUSTRY'S BIGGEST BUY FOR DIGGING 7-FT. DITCH

The new Barber-Greene Model 774 Wheel Ditcher can be equipped with a 7-ft. wheel with complete options and accessories for 50% less than you pay for any other wheel ditcher that can dig this depth. Call for prices and be convinced.

Crawler, rubber-tired Barber-Greene Vertical Boom Ditchers cut low costs trench from 5½ to 24-in. wide and to 7 ft. deep. Model 784 is shown.

Manufacturer of the only modern ditcher line

Representatives in Principal Cities of the World

Barber-Greene BG

Main Office and Plant AURORA, ILLINOIS, U. S. A.

Plants in DeKalb, Illinois..Detroit..Canada..England..Brazil..Australia

CONVEYORS • LOADERS • DITCHERS • ASPHALT PAVING EQUIPMENT

"GAS DOES IT BETTER, NATURALLY"

KRALOY

PIPES GAS BETTER, NATURALLY!

SEE PAGE TO THE RIGHT FOR THE FULL STORY ON THE LEADING PVC PLASTIC PIPE FOR THE GAS INDUSTRY – **KRALOY.** MAIL COUPON FOR **FREE** 36-PAGE ENGINEER'S HANDBOOK ON KRALOY PVC PLASTIC PIPE.

KRALOY PLASTIC PIPE CO., INC.

Dep't. GM-3, 402 West Central Avenue, Santa Ana, California

Gentlemen:

We are interested in the many advantages of KRALOY for the gas industry. Please send your FREE 36-page Engineer's Handbook on PVC Plastic Pipe.

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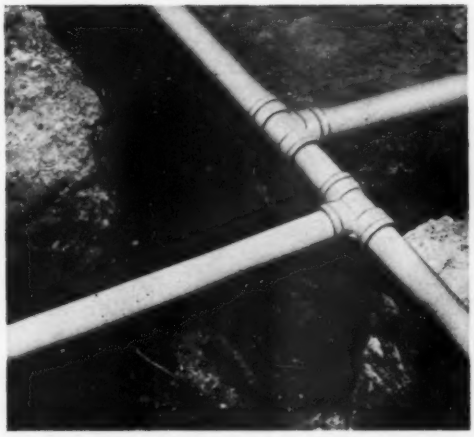
NOTHING PIPES LIKE **KRALOY**

Found: THE ANSWER TO CORROSION, ELECTROLYSIS AND HIGH MAINTENANCE COSTS IN GAS LINES – *Kraloy high impact PVC Plastic Pipe provides permanent, trouble-free service at as little as 1/3 the cost!*



Narrow trenching and simple above-ground assembly of 2" mains are possible with lightweight KRALOY PVC Plastic Pipe Fittings are "welded" on with brush and solvent

KRALOY PVC Plastic service pipe can be led off existing plastic main by simple tapping procedure and solvent-welded plastic service tee. KRALOY is immune to rust, rot, electrolytic action.

Gas industry experts are turning in increasing numbers to *the* pipe that has proven to be most versatile and trouble-free in both main and service pipe installations—KRALOY PVC High Impact Plastic Pipe.

Impervious to galvanic or other ground corrosive actions, unaffected by electrolysis, rot or rust—KRALOY not only gets rid of sour and dirty gas headaches, but likewise most efficiently conquers other gas piping problems. KRALOY is cheaper to install. Light in weight, its flexibility and ease of making joints and bends simplifies transportation, handling and laying.

FIGHTS BOTH SOUR GAS AND COSTLY SOIL CORROSION

Quality protected by continuous laboratory control, today's KRALOY Pipe is precision extruded from basic compounds best suited to the job With its inert, non-conductor anti-rust, rot and corrosion characteristics —and its smooth, mirror-finish interior walls that permit faster, freer output (up to 20%) through smaller pipe sizes—today's KRALOY gives you the right combination of permanent, trouble-free qualities to pipe the greatest volume of gas at the lowest cost.

KRALOY GIVES YOU THESE FEATURES

1 KRALOY is permanent—not subject to electrolysis, rot, rust or scale needs no paint, coating, lining or cathodic protection . has the ability to withstand all ground corrosive actions.

2 KRALOY'S high impact strength withstands abuse before and after installation.

3 KRALOY'S lighter weight (1/8 that of steel) enables 1-man handling, lets your trucks carry more pipe footage.

"Gas Does It Better, Naturally". . *and even better* with KRALOY PVC Plastic Pipe! Available in all sizes from 1/4" to 12" with plastic fittings Specify KRALOY for pipe *you can depend on* to do the job.

FREE-New 36-page Engineer's Handbook on PVC Plastic Pipe. Address Kraloy Plastic Pipe Co., Inc., Dept. GM-3, 402 W. Central Avenue, Santa Ana, California

K 59 21

NOTHING PIPES LIKE **KRALOY**

This photograph vividly demonstrates the excellent resistance of AMERICAN DUCTILE IRON® pipe to impact. After receiving the full force of a 3½-ton weight being dropped from a height of 25 feet, the pipe remains in one piece. The clearly defined puncture caused by the tip of the weight is an indication of the superior strength and impact resistant qualities of AMERICAN DUCTILE IRON ® pipe.

3½-TON WEIGHT DROPPED FROM 25 FEET FAILS TO SHATTER AMERICAN DUCTILE IRON® PIPE

Super-service requirements such as high internal gas pressures, heavy crushing loads and extreme shock loads can be met with extra-tough, bottle-tight AMERICAN DUCTILE IRON ® pipe. This pipe offers important advantages of both iron and steel, possessing the time-proven corrosion resistance of gray cast iron without the expense and inconvenience of special wrappings or special protective devices... and yet having high strength to withstand extreme installation and service stresses.

In crossing busy highways, under deep covers and fills, where shifting soil or earth settlement may be encountered... specify AMERICAN DUCTILE IRON ® pipe for gas service.

AMERICAN DUCTILE IRON ® pipe provides extra safety factors for all standard distribution pressures ... is easy to tap without saddles or welding... withstands shock in shipment, in installation, in service.

If you expect the extreme conditions, investigate AMERICAN DUCTILE IRON ® pipe. Your nearby American Cast Iron Pipe Company representative will furnish complete facts. Write for illustrated catalog.

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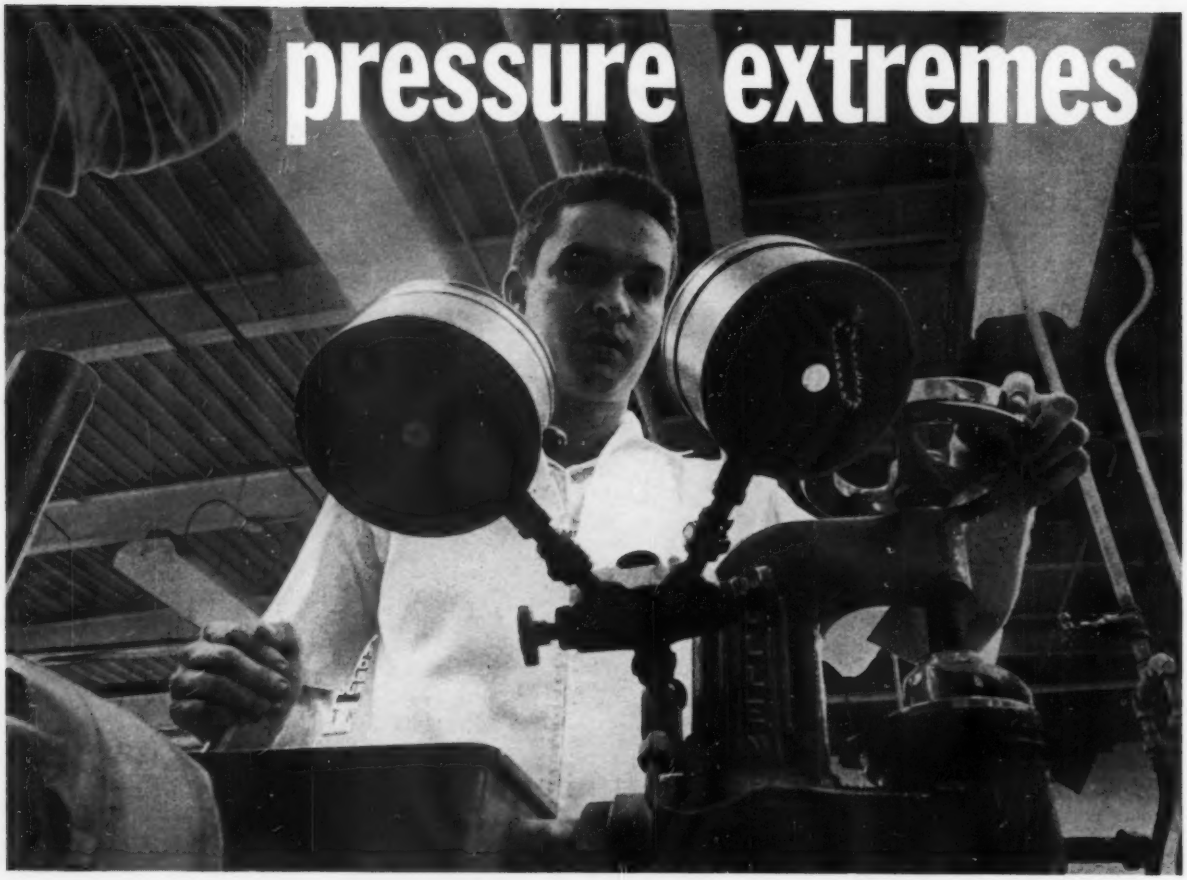
SKINNER-SEAL

BELL JOINT CLAMP

When you clamp a bell and spigot joint, you want PERMANENCE. In the SKINNER-SEAL Bell Joint Clamp, massive malleable iron construction, gasket SEALED by monel metal band, oversize corrosion-resistant bolts . . . combine to make a tight, lasting, completely reliable installation. Four-page folder with drawings, photographs, specification tables, sent free upon request.

M. B. SKINNER CO., SOUTH BEND 21, INDIANA

you don't worry about pressure extremes



The Mullen Burst Test, being run here at our lab in Buena Vista, Virginia, is the yardstick to determine maximum resistance to burst to make certain the material conforms to specifications.

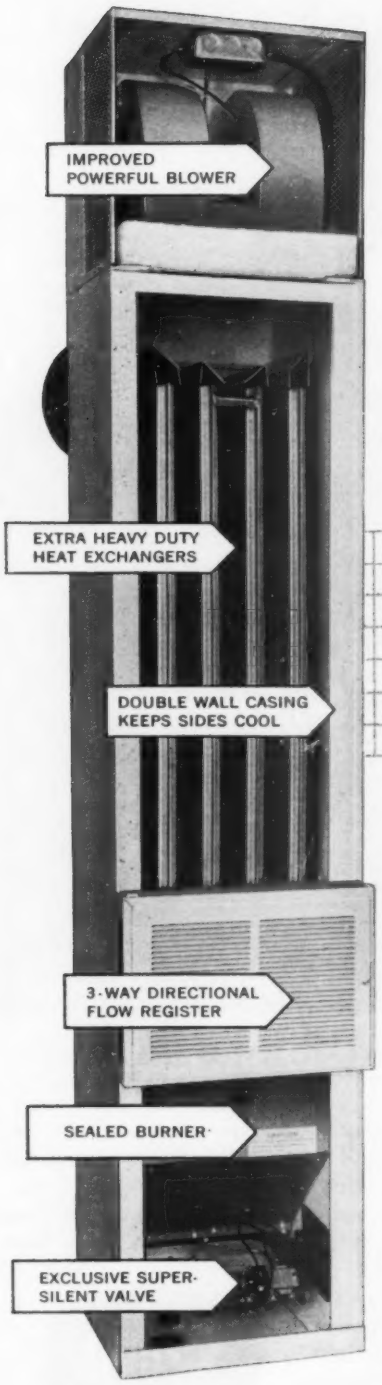
with Reeves-Vulcan Diaphragms

One of the numerous inspections in our system of quality control is the Mullen Burst Test. This inspection is used on every roll of coated fabric before it is shipped or made into diaphragms.

From the gross psi readings of this test, we can assure you that Reeves Vulcan Diaphragms will safely withstand the pressures listed in our specifications.

You name the application — we'll supply the right diaphragm or diaphragm material for your specific needs. For prompt action, call or write us today.

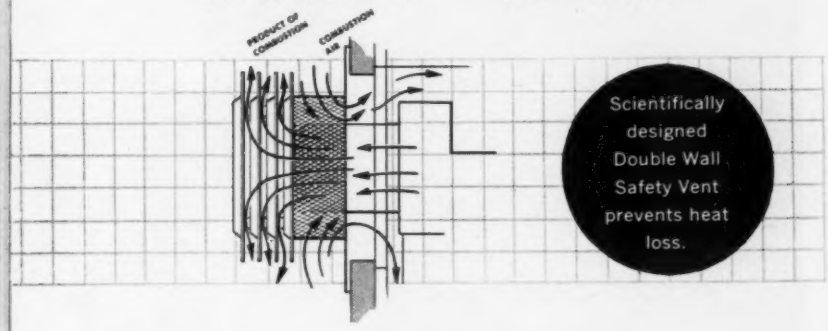
REEVES GEM VULCAN
RUBBER PRODUCT
Reeves Brothers, Inc., Vulcan Rubber Products Div.
1071 Avenue of the Americas, New York 18, N. Y.



Ideal for New Construction, perfect for Replacement

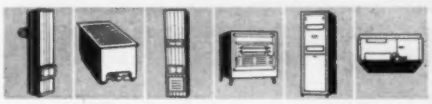
efficiency tests prove Empire direct vent line gives 7.8% more heat

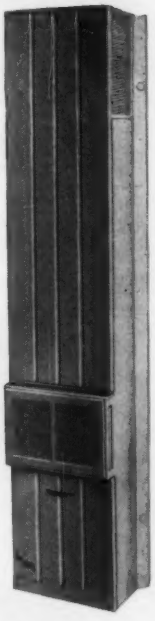
NO CHIMNEY NO DUCTS



Scientifically designed Double Wall Safety Vent prevents heat loss.

Now, Empire proves gas heat is the *only* modern, economical heat. These "hidden" reasons, proven and tested, makes selling easier and quicker. A complete range of models are available . . . from 10,000 BTU to 70,000 BTU.





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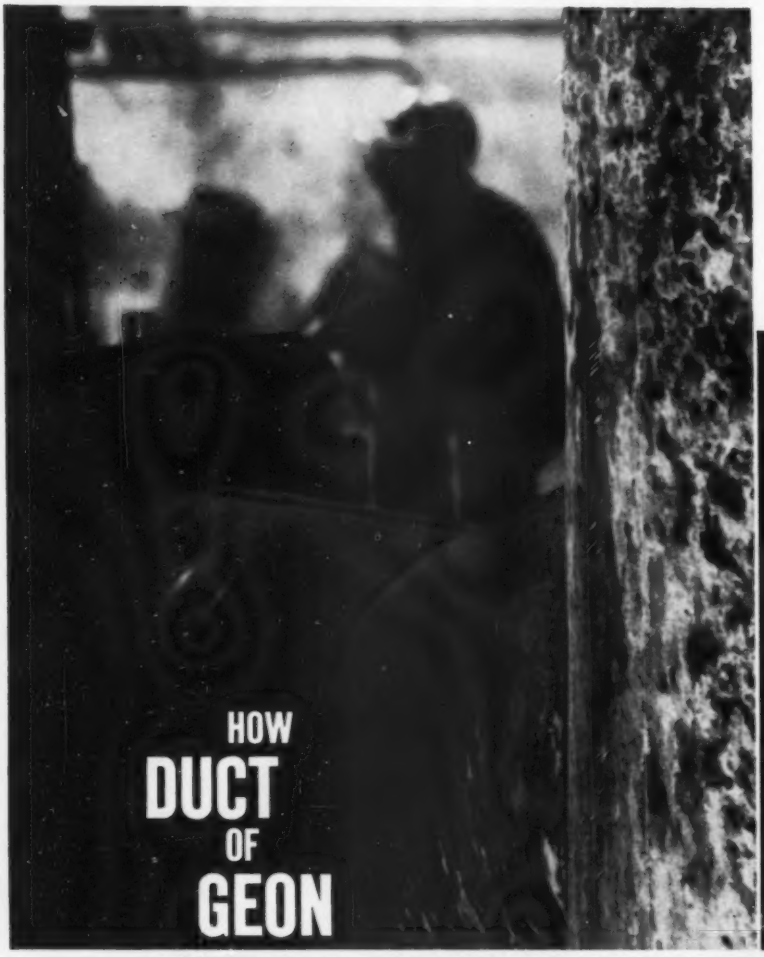
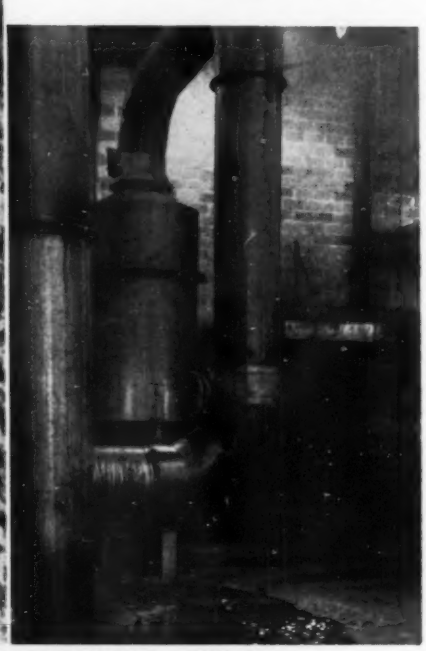
Another new development using

B.F.Goodrich Chemical *raw materials*



The large duct shown here was fabricated of Geon vinyl by Colonial Plastics Mfg. Co. through their distributor, Gould-Kramer, Inc., Cleveland, Ohio. B.F.Goodrich Chemical Company supplied the Geon vinyl.



CONQUERS CORROSION IN CHLORINATION ROOM

A tougher corrosion problem than this one would be hard to find. That's why all the large round duct you see is fabricated from rigid sheet made of Geon vinyl.

This room is where spent gases are carried from chlorinating operations to storage tanks. The atmosphere is such that personnel must wear goggles and face masks at all times. Corrosion would make short work of most ductwork or pipe.

But Geon is unaffected by acids, oils or many hydrocarbon chemicals. It is easy to fabricate, light in weight, and simple to install. Duct, pipe—even complete fans and valves—made of Geon are solving corrosion problems throughout industry.

For more information on products made of Geon vinyl—or on this versatile material itself—write Dept. GS-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon VINYLS

B.F.Goodrich Chemical Company
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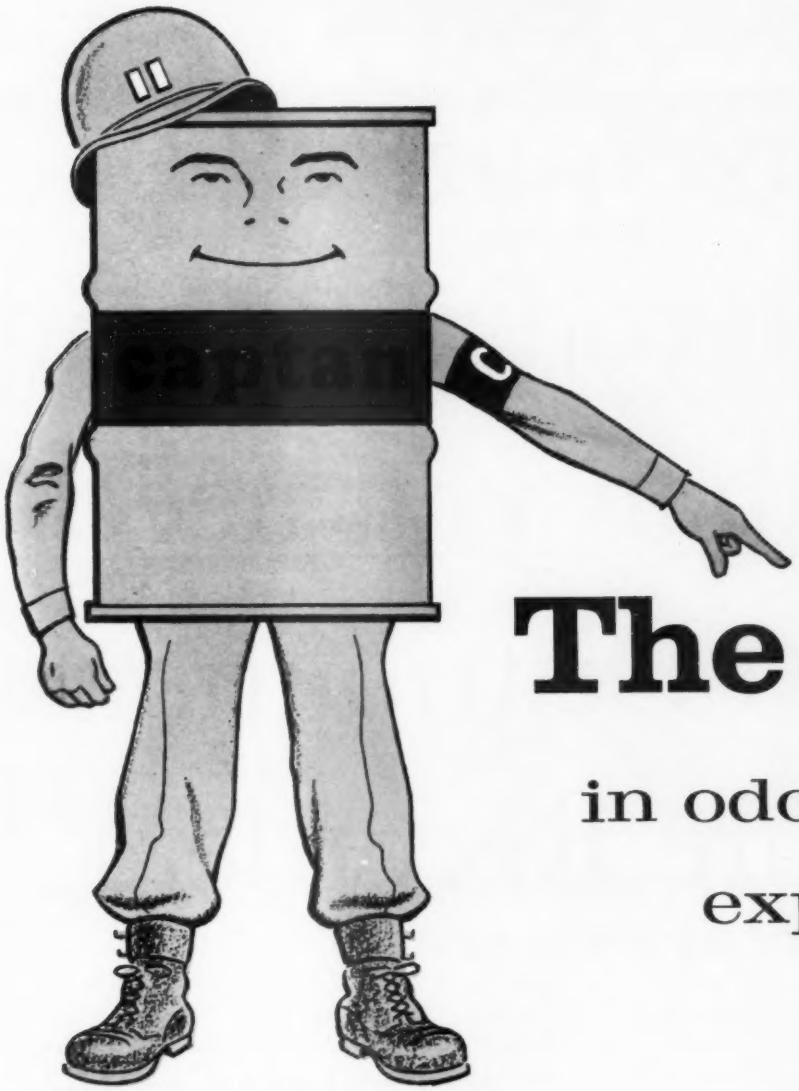
GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers



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Quick quiz tells whether you're paying more than you need for Gas Distribution Pressure Recorders

YES	NO		
☐	☐	Can you get easy-to-read 12" charts without paying extra?	from Foxboro you can!
☐	☐	Can you get a fully weatherproof case without paying extra?	from Foxboro you can!
☐	☐	Can you get a 100% submersible case for flooded areas?	from Foxboro you can!
☐	☐	Can you get one standard recorder for both permanent and portable applications?	from Foxboro you can!

A check in the "NO" column means your Foxboro field engineer can save you money —why not call him? The Foxboro Company, 343 Norfolk St., Foxboro, Mass.

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LimiTorque
VALVE CONTROLS

...operate 8" GROVE THRU-CONDUIT VALVES ON MANIFOLD, at a large natural gas company

The LimiTorque Valve Operators shown above are of the *Integral Control Type* (another first by LimiTorque) . . . These self-contained "packaged units" offer integral mounted NEMA rated reversing controllers, push-button and indicating light elements . . . The push-button elements, selector switches, etc. are mounted inside the hinged cover for quick, easy accessibility.

LimiTorque "Integral Control" Operators can save up to 50% over separate component equipment and installation costs—and, they are simple, foolproof and absolutely dependable. Send for LimiTorque Bulletin 10-A-58, which completely describes and illustrates these new and exclusive Valve Operators.

LimiTorque is the most widely used automatic valve operator—thousands are operating day and night on Pipe Lines and in Refineries throughout the world. The wide preference for LimiTorque stems from previous performance under all service and climatic conditions: heat, cold, dust, fumes, sleet, snow and rain.

There is no guess work or labor connected with LimiTorque Valve Controls—one key man can open and close any type of valve, quickly and dependably in remote or hazardous locations; thus pipe line and refinery operation procedure can be handled easily and safely.

LimiTorque may be actuated by any reliable power source, such as Electricity, Oil, Gas, Water or Air.

LimiTorque Controls can be field-mounted on existing valves . . . contact your valve manufacturer or nearest LimiTorque sales-engineering office.

THERE IS NO SUBSTITUTE FOR —
LimiTorque®

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
Limitorque Corporation • King of Prussia, Penna.

Williams Brothers taping a section of Northern Natural Gas Company's 20" Minneapolis-Duluth transmission line.

POLYETHYLENE TAPE by SEAMLESS

used for coating 53 miles of 20" main line in Northern Minnesota

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Here are the results...

- Actual construction time, 31 days.
- Reduction in construction costs.
- Less equipment required.
- Despite numerous swamps and peat bogs, the tape crew averaged approximately 9,000 feet per day.

Whether for main-line construction or an accessory application, Seamless has a specific tape for your installation. Write for field specifications and particulars.

SAFE-T-CLAD DIVISION

THE SEAMLESS RUBBER COMPANY

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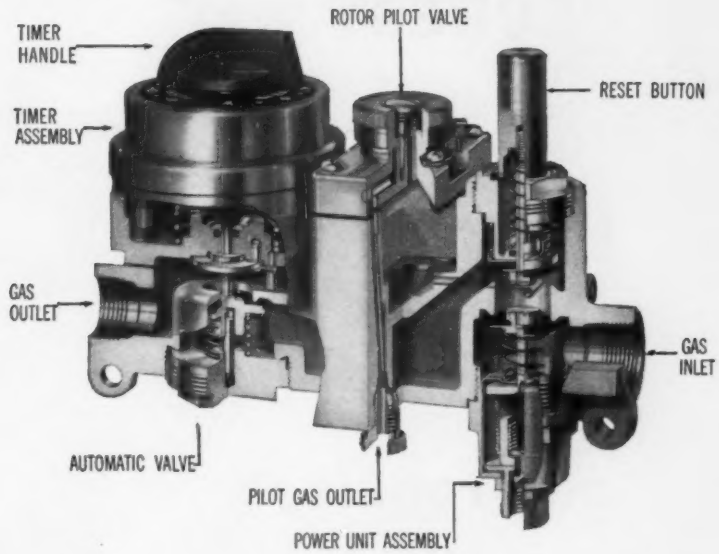
A SUBSIDIARY OF THE REXALL DRUG & CHEMICAL COMPANY

BASOTROL® INCINERATOR CONTROLS

...designed for minimum and maximum timed burning cycles



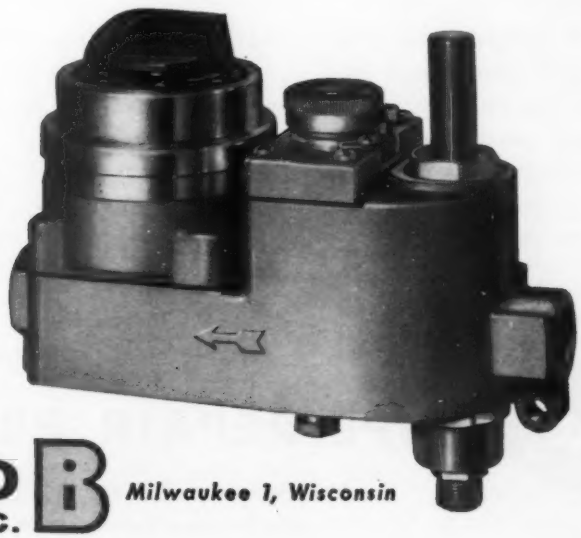
Basotrol valves for gas incinerators are designed to give minimum and maximum timed burning cycles, assuring complete combustion of waste material. At the same time these Basotrol valves provide a complete automatic shut-off of main burner and pilot burner gas, if and when the pilot burner should be extinguished.

The main burner timer clocks are available with the following timing cycles: a maximum burning cycle of 4 hours with either 1, 1½, or 2 hours. Other timers, whose minimum time-on may go as low as 30 minutes, are available on special order. Timers come with blue or green dials, and with aluminum figures as specified.

All of the Basotrol valves are equipped with the Baso *automatic pilot* for complete shut-off of main burner and pilot burner gas . . . *rotor pilot valve* with built-in adjustment for *on-off* pilot burner operation . . . *semi-automatic main burner* valve with a maximum 4-hour main burner operation cycle . . . *pilot gas filter* for less pilot outage. All operating units are replaceable for quick and easy servicing.

Install a Basotrol valve in your new gas incinerator. Pipe size: ⅜" N.P.T. Capacity: Natural Gas at 1" W.C., 82,880 Btu/hr.

For more information about Basotrol valves, *write* Baso Inc., Dept. SC-1, Milwaukee 1, Wisconsin.

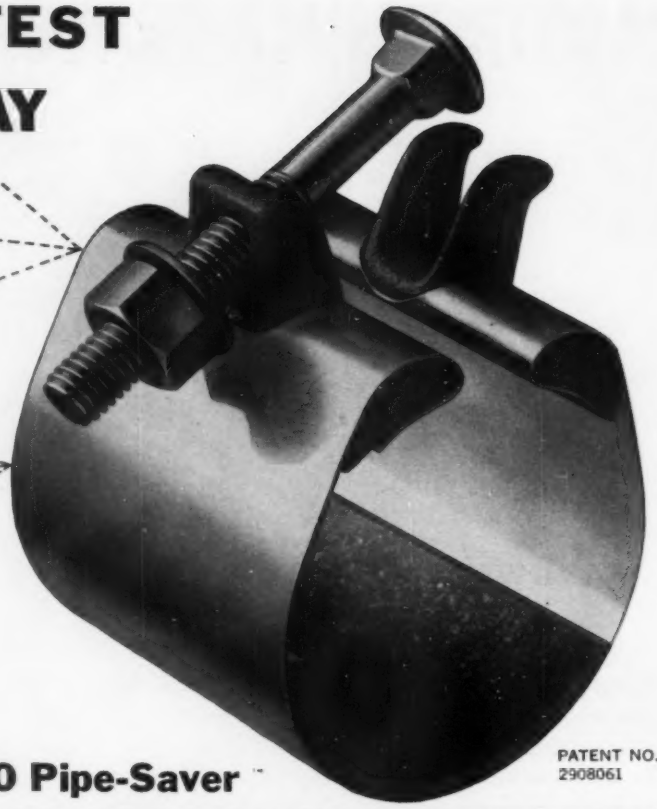


BASO INC. *Milwaukee 1, Wisconsin*

FASTEST, SAFEST SUREST WAY

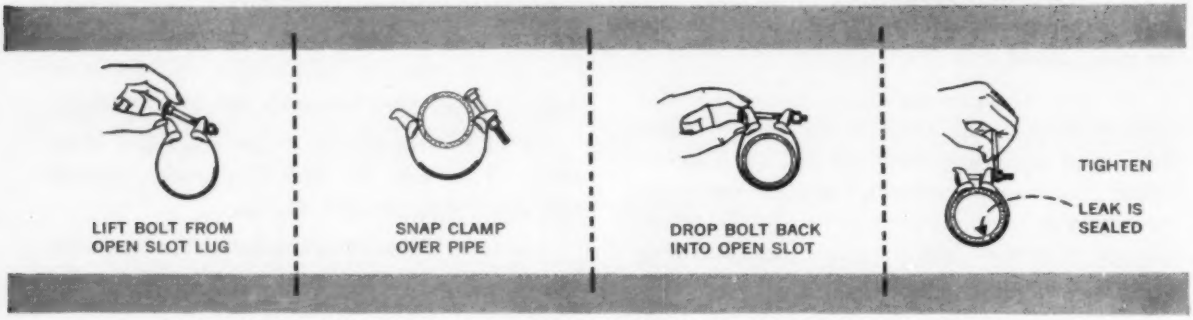
to stop pipe leaks

and repair splits!



PATENT NO. 2908061

Famous Adams® No. 220 Pipe-Saver



EASIEST AND QUICKEST TO INSTALL, Adams Pipe Saver clamps assure a 100% pressure-tight seal without need for complete line shut-down!

Adams resilient neoprene gasket closes cracks or holes *instantly, completely, permanently!* Adams patented contour lug design and flexible stainless steel band eliminate the danger of crushing weak pipe!

Adams Pipe Saver clamps are so resistant to corrosion they *outlast the pipe.* They have high salvage value, have never been known to be damaged by pressure!

Order Adams No. 220 Pipe Saver clamps in pipe sizes from ½ to 8″, in lengths from 3″ to 12″. (Up to 24″ pipe size by 18″ clamp length, on special order).

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Sales Office and Warehouse: Columbia, Penna.

Even your dome light draws more current than MOTRAC 2-way radio!

Motorola ends costly power drain problems and idling expense with the first fully transistorized receiver and power supply

What makes Motorola MOTRAC radio the most economical and reliable 2-way radio unit in the annals of mobile communications? Not just one or two new features, but a score of revolutionary design advancements that bring you the very finest set ever engineered.

1. On standby—the MOTRAC receiver draws only a trickle of current—actually 80% less than conventional units—with an occasional increase to maintain crystals at proper temperature for precise on-frequency operation (even your dome light draws more current than MOTRAC radio). Yet, this radio is always poised for instant reception, thanks to its fully transistorized receiver. Result: no life-shortening battery drain . . . no more costly, unnecessary engine idling.

2. MOTRAC radio eliminates the most common maintenance problems: vibrators in the power supply and tubes in the receiver. All are replaced by stabilized long-life transistors.

3. Up to 40°F cooler operation means less aging and strain on components. Reason: no more receiver tube filaments; a more efficient power supply; a battery saver switch to cut off transmitter filaments; and two separate heat sinks—one for power supply, another for transmitter output tubes.

4. The MOTRAC receiver operates directly from the 12-volt battery; its low voltage operation results in less electrical strain on components, assures long life.

5. Traditional Motorola engineering and production excellence are evident throughout MOTRAC radio. Transistors undergo three separate checks, including a week of stabilization at 185°F. Only industrial-type tubes, especially suitable for the rigors of mobile operation, are used in the transmitter.

6. Patient production testing continues under stringent quality control procedures. First, each module is tested. Then each chassis is independently checked. Next, each radio is tested as a composite whole. Finally, the entire radio and associated accessories are checked out as a complete operating system.

7. MOTRAC radio is conservatively designed. The receiver has *even higher* reserve gain than conventional Motorola units to assure *peak performance* for many years. Also, power supply transistors are operated under an exceptionally high safety factor to assure extended service life.

8. Completely independent receiver and transmitter chassis, with no power supply in common, assure reliable reception regardless of transmitter performance.

9. MOTRAC radio offers you 2½ to 3 times higher audio output than conventional sets.

10. MOTRAC radio is designed for split-channel operation. *Both* receiver and transmitter meet critical split-channel stability frequency requirements.

Experienced users have been field testing MOTRAC radios for many months. The results are in—and they're excellent. We'd like to tell you *all* about them. Write, wire or call: Motorola Communications & Electronics, Inc., A Subsidiary of Motorola, Inc., 4501 West Augusta Blvd., Chicago 51, Ill., SP 2-6500. MOTRAC is a Motorola, Inc. trademark.

TOUGHNESS... can be jacked through fill on casings under highways and railroad track — will not crack or break under earth movement, frost action, loads or vibration.

+ PERMANENCE... unaffected by time or the most severe conditions . . . for life.

+ DIELECTRIC STRENGTH

... withstands 500 volts per mil with freedom from holidays or breakdown.

= Epi-SEAL® EPOXY

PIPE and CASING COATING

FOR PROBLEM CORROSION AREAS

Overwater — 14" steel pipeline in harbor area was severely corroded from salt spray, weather, etc. After paint and several other coatings proved unsatisfactory, pipe was coated with Epi-SEAL Resin and glass tape while in service, stopping leaks and completely eliminating further maintenance.

Underground — For jacking under railroad fill three 100' by 12" casings were double-wrapped with glass tape saturated with Epi-SEAL Universal Resin. During jacking operation, after an overnight work stoppage, the fill had tightened and seized one casing — a crane promptly twisted and jerked the casing free and it was pushed on through. What other coating could take this kind of punishment?

It will pay you to consider Epi-SEAL Epoxy Coatings for your "Toughest" Spots.

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Formulators and Manufacturers of Resinous Products for the Gas Industry

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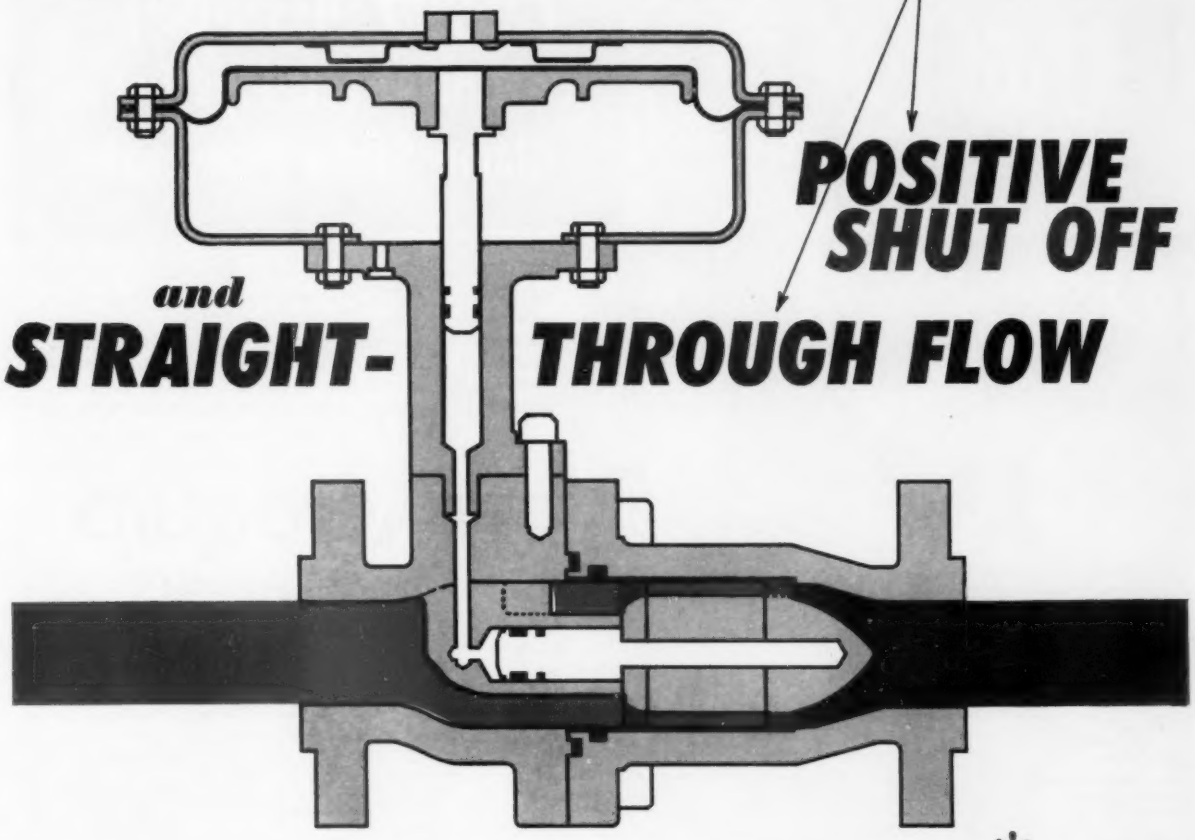
At last! A pressure reducing gas regulator with...



POSITIVE SHUT OFF

and

STRAIGHT-THROUGH FLOW

The NEW Jet Stream Regulator

Now you can stop high-speed gas turbulence, sound vibration, and leakage in your pressure regulators. The Jet Stream Regulator gives you straight-through laminar flow, positive shutoff, and no mechanical friction. Jet Stream's laminar flow stops the jetting of high speed gas and transient particles. This smooth straight-through flow also reduces sound vibration. Jet Stream's hydraulically actuated slave piston regulates flows with extremely fine control... from full flow to bubble-tight shutoff in three seconds. For efficiency and safety in your pressure reducing gas regulators... *use a Jet Stream Regulator!*

* *manufactured under the Welker Patent*

THE JET STREAM REGULATOR IS MADE IN THREE MODELS

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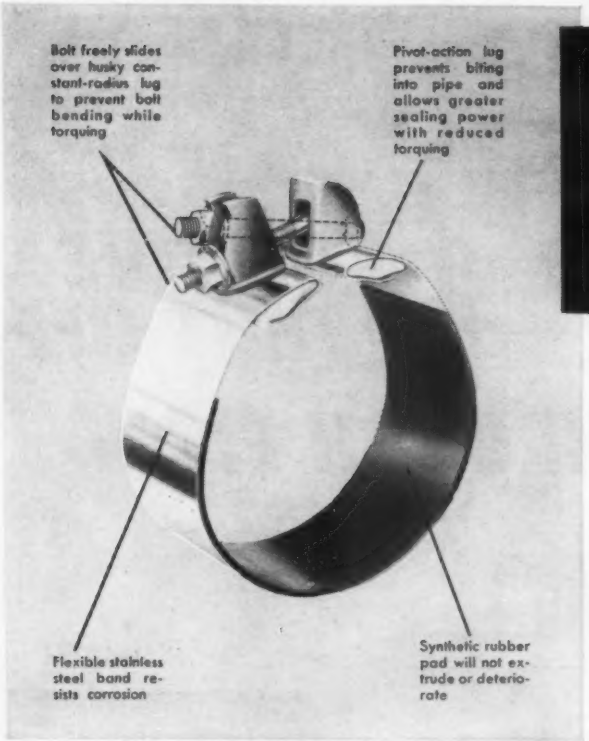
Bolt freely slides over husky constant-radius lug to prevent bolt bending while torquing
Pivot-action lug prevents biting into pipe and allows greater sealing power with reduced torquing
Flexible stainless steel band resists corrosion
Synthetic rubber pad will not extrude or deteriorate

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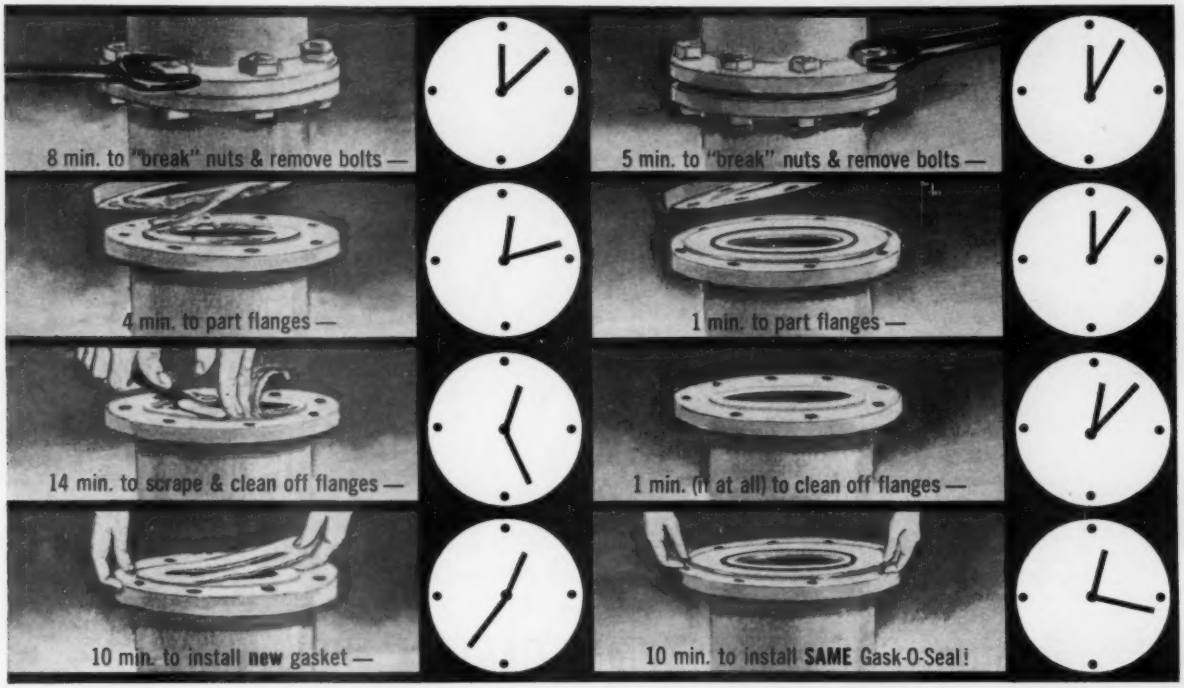
8 min. to "break" nuts & remove bolts —
4 min. to part flanges —
14 min. to scrape & clean off flanges —
10 min. to install new gasket —
5 min. to "break" nuts & remove bolts —
1 min. to part flanges —
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TOTAL TIME 36 MINUTES | **TOTAL TIME 17 MINUTES**

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There is no scraping or time consuming cleaning of flange faces necessary when you use Gask-O-Seals; no damaged flanges to be re-surfaced or replaced. And, Gask-O-Seal offers many other cost reducing features:

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5. PERMANENT. *You save money* on replacement, because H-B curb boxes are completely permanent . . . remain unharmed by either moisture or soil acids.

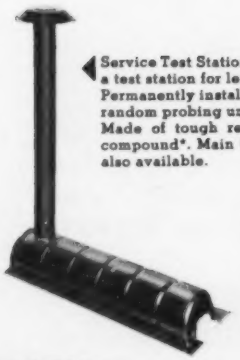
6. CUT STORAGE AND HANDLING COSTS. H-B curb boxes *save you money* because they are packed five to a container. They're not only easier and *safer* to handle, but easier to store and stack.

7. FULLY ASSEMBLED. Unpack a container of five H-B curb boxes and *you save money* because they are fully assembled . . . ready for installation.

IT WILL PAY YOU to specify Handley Brown Curb Boxes. Leading gas utilities all over the Country (names on request), are making the switch to H-B after rigorous on-site tests. A representative will be glad to show you the advantages. Write today for information.

End callbacks with attractive H-B outside meter boxes. Available as shown, or for recessed installation. Made of tough resin-rubber compound*.

Master Poly-Trol *automatic* gas shut-off valve. Shuts-off gas in event of overpressure, underpressure, excessive high temperature, and flooding. Serves also as a tamper-proof manual shut-off.



Service Test Station. Provides a test station for leak surveys. Permanently installed. Makes random probing unnecessary. Made of tough resin-rubber compound*. Main test station also available.

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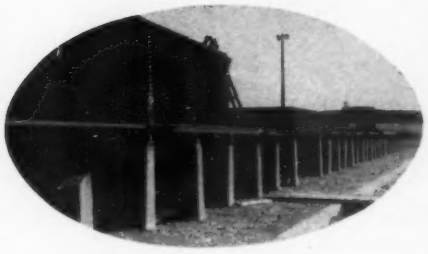
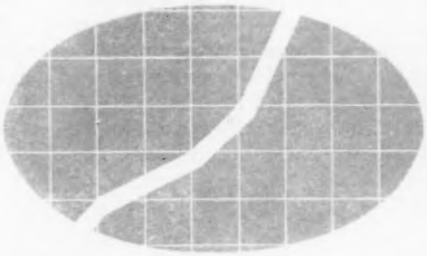
Corrosion prevention in gas distribution systems

A perusal of the literature might convince one that corrosion prevention is simple and technically specific. Not so in the case of distribution systems, says Dave Price. And in this article he covers many phases of a corrosion elimination program in a gas distribution system, presenting ideas and techniques which will help reach this objective (page 68).



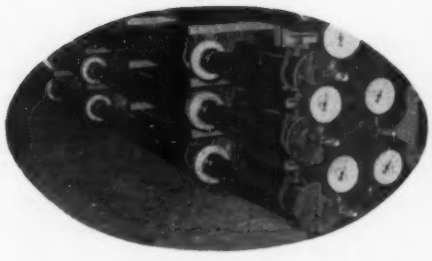
Modern plant coats pipe

Some time ago we asked an expert where he thought the best coating yard in the country was. He answered: "Down in Memphis, Tenn." Here, then, is a first-hand description of that coating yard, its equipment and its operation (page 74).



Plastics pipe: The infant is becoming a child

More gas companies are accepting plastics pipe and using more and more of it. That is a thumbnail sketch of GAS' Annual Survey of Plastics Pipe Usage in the Gas Industry. The full facts from the only survey of its kind are presented in this article (page 78).



Testing butyrate pipe

Any good product—plastics pipe included—begins in a physical testing laboratory. As the plastics industry has grown, so has its quality control and test work. Here is how one company evaluates its own plastics pipe product to assure its performance under the final test—field service (page 91).

plus

Many other exclusive features on corrosion prevention and plastics pipe, highlighted by such articles as "A History of Cathodic Protection," or one company's saga of its cathodic protection problems and solutions since 1934 (page 129).

CORROSION PREVENTION

Here is a complex engineering problem

Corrosion prevention in gas distribution systems

By DAVID P. PRICE, Corrosion Engineer
Montana-Dakota Utilities Co., Glendive, Mont.

MUCH of the literature and many advertisements concerning anti-corrosion materials and methods can lead a person to believe that corrosion prevention is comparatively simple and all technical problems have been solved. Eliminating corrosion on a well-coated transmission pipeline is normally not too difficult. But protecting a gas distribution system against corrosion is often very difficult.

Painstaking attention to all details is necessary in regard to coatings, insulation, and cathodic protection. The educated use of many available tools is needed in a corrosion prevention program. Education of personnel is absolutely required. Communications between corrosion engineers and the "man in the field" are essential.

This article covers most of the phases of a corrosion elimination program in a gas distribution system, presenting ideas and techniques which will help accomplish this goal successfully.

• Is corrosion protection necessary in a gas distribution system?

Any expenditure which is made by a gas utility company certainly has to be justified. In many gas distribution systems where corrosion has not been and is not a problem, and where most of the pipe is uncoated, corrosion control measures are not justified. It is sometimes difficult to calculate economic justifications for coatings and cathodic protection because of many irreducibles. An explosion due to a gas leak could result in the loss of lives and/or valuable property. News of a gas explosion spreads rapidly to all sections of the country. The final cost of an explosion and its effect on the public cannot be determined in dollars and cents. But it is certainly worth spending many dollars to prevent the gas leak which might result in an explosion.

Therefore, if a corrosion problem does exist in a city distribution system, corrosion mitigation efforts and measures can be considered as a necessity. The problem then is to determine the most economical and effective corrosion elimination program. This means that a coating selection is necessary, an effective method of insulating service lines must be chosen, a cathodic protection system must be designed, and personnel must be educated to effectively install and maintain these tools.

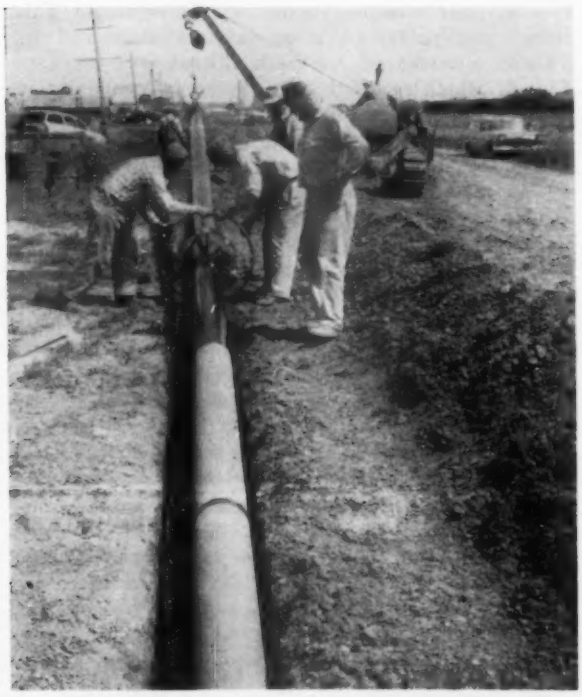
• Coatings

In a gas distribution system, it is desirable to apply the best possible coating to piping for some obvious reasons. First, a gas company generally depends on the pipe to last as long as possible because of the nature of its business. Second, and this reason is becoming increasingly more important, pipe with an excellent coating takes much less cathodic protection current, thereby resulting in less danger of stray current pickup by other metallic underground structures.

Selection of the best coating for usage in any particular area is becoming very difficult. Many new coatings are developed each year, and with high powered advertising and glib-tongued salesmen peddling their products, it is difficult for a selection to be made. An engineer or operating man finds it hard to determine which coating is best suited to his requirements because each manufacturer has a brochure which contains test data conclusively proving that its product is the best available. A certain coating tested against competitor's products X, Y and Z,

Fig. 1. Test bench made for evaluating results of coatings salt crock tests.

Results of the salt crock test on one brand of hand-applied tape.



Field tests are most beneficial in evaluating merits of a coating. Here a crew applies a plastics-type tape while a corrosion engineer looks on. Two other experimental coatings were applied to this line. All three sections were insulated from each other and from other pipelines so that an accurate comparison could be made.

is proven to be the only one which withstands nature's corrosive elements satisfactorily. No doubt, each manufacturer sincerely believes that his coating is best for use in any environment. But many coatings which suffice in certain areas, do not provide adequate protection in other areas.

Each company should make its own evaluation of the various coatings. There are many tests which can be made. Most of these tests are thoroughly described in the literature. Two of the most practical tests are the "salt crock" and "soil stress." These can be conducted separately or together. Results are usually enlightening (see *Fig. 1*). Information can also be gained from other utilities operating in the same general area. This information, if based on long-term field experience, is usually more valuable than any obtained from short-term laboratory tests, even though laboratory tests are accelerated. Actual test sections on pipelines are also excellent, but necessarily are usually long term tests.

Most gas utilities now have their distribution system pipe coated at a coating mill before delivery. Much of the pipe is then stored so that a minimum of coating damage occurs before installation—provided care is also taken in handling the coated pipe. The coating problem then becomes one of selecting the best hand-applied type of coating for use on joints and fittings. Joints and fittings can be the "Achilles Heel" of the coating process because their coating job must be done in the field and sometimes under adverse conditions. It is necessary to select

a coating which will be compatible with the mill coating on the pipe.

The importance of properly coating joints and fittings cannot be stressed too often. For example, recently a Montana-Dakota service crew dug up a service line in order to repair a gas leak which had been located. The cap of a service tee was found to be almost corroded off. The tee and adjacent piping had been coated, but, for some reason, the cap had not been coated. Corrosion occurred in only a few years. This was certainly a practical lesson for the crew. It could have been a costly one.

Practical demonstrations of coating techniques for men in the field help greatly to improve quality of hand coating applications. However, it is not enough to illustrate these methods once and assume that forever after a dependable job will be done. Repetition of the demonstrations is sometimes necessary due to an inclination by some workmen to become lax in coating techniques after a time. Periodic inspections by corrosion personnel and manufacturer's representatives are also necessary to insure continued correct coating application in the field.

In some old, predominantly uncoated distribution systems in our properties, where very little cathodic protection has been applied because of excessive current demands, leaks have dropped off markedly due principally to a coating campaign which was started about seven years ago. Prior to that time, joints and fittings coating was done haphazardly, at times, with a variety of doubtful materials. Coating application education will pay off! It will continue to do so as long as there is no lessening of effort on the part of all concerned!

Many new and interesting coatings have appeared and are appearing on the market. Some or one of these may be the perfect coating or coatings of tomorrow. Most new coatings have merit enough to warrant testing and, possibly, the installation of a few test sections of pipeline. But let us not abandon our proven coatings (such as coal tar) until newer coatings have had a few years' testing in the field. There is too much at stake to risk coating an entire pipeline system with a questionable product.

• Insulation

The second, and also very important step in protecting gas piping from corrosion, is to isolate or insulate the gas system from other metallic underground networks. In some cases, when joint cathodic protection contracts have been negotiated, this may not be necessary; but in most cases, insulation is desirable.

At most residences, a water line and a gas line are attached to the water heater. To separate the water system from the gas system, an insulator of some type must be inserted into the gas line. Where the gas is metered outside of houses, either at the property lines or alongside the houses, insulation can be accomplished easily and effectively by installing insulating meter swivels or insulating unions.

However, in northern regions of the United States and in Canada, most meters are installed inside, usually in basements. Here, the problem of service line insulation becomes much more complex. Homeowners inadvertently find many ways to render an insulating swivel useless. They make the meter and gas piping a convenient place on which to tie metal clothes lines, for example. All sorts of metallic objects are stored on gas and water piping, effectively joining them from a conductance standpoint. Water lines, electric ground wires, and conduit all are accidentally grounded to gas lines on the cathodically energized side of insulating swivels. Any one of these "foreign contacts" can short an insulating meter swivel. Metal walls, concrete reinforcement and stucco screening can all short an inside insulator even though the insulated swivel or union is in itself effective.

On new gas service line installations, it is much more effective to insulate in the risers on the outside of houses. This method is illustrated by *Fig. 2*. It also is a much simpler task to check service line insulators when they are installed in this manner. Unfortunately, many times insulating devices are damaged during installation because of excessive tightening by a burly pipefitter or for other reasons. They can then become conductors. Locating a faulty insulator can be very tedious work because one shorted insulator will generally affect the cathodic protection level on several blocks of a gas distribution system. A voltmeter can only narrow down the location of a faulty insulator even when used in conjunction with a current interrupter.

Early this year, GoodAll Electric Mfg. Co. (Ogallala, Neb.) started marketing an insulation tester which is definitely a valuable addition to the distribution system corrosion engineer's bag of tools. This tester was patterned after the one developed by Thomas Snedden of Northern Illinois Gas Co. (see *Fig. 3*) which received such widespread publicity in 1958 (GAS, March 1958).

The insulation tester will speed up location of faulty insulators by giving a definite test at each service line. Because of the multitude of service line insulators within a company's properties, it is sometimes desirable to provide one or more insulation tester for each division and to train division personnel in their usage. It is much less costly to detect a faulty insulator and to change it during construction than it is to change the insulator afterward.

Much of a distribution system can be insulated by installing insulating swivels on replacement meters when they are changed for testing purposes. The cost of insulating each service line by this method is very low.

It is often desirable to sectionalize certain parts of a city distribution system. This can be done by installing insulating flanges in mains. Current drainage from the various sections can be controlled across insulating flanges by means of resistance bonds. Each bond is a control point and can be compared with a valve in that it is a current regulatory device, just as a valve is a fluid regulating device.

• Cathodic protection

It is generally agreed that cathodic protection of a coated or predominantly coated system is not only desirable but is a necessity. Design of a cathodic

protection system is a new and distinct engineering problem in each distribution system because of variations in soil, coatings, and system size.

Preliminary steps in the design of a cathodic protection network for cities are as follows:

1. Acquisition and study of maps of all underground metallic systems.
2. Determination of underground soil characteristics and resistivities.
3. Determination of current demand by:
   a. Calculation using electrical constants where coating is believed to be uniform.
   b. Estimation by comparison with similar piping systems.
   c. Direct current requirement tests where actual but temporary protection is produced. This is the most satisfactory method if most of the gas system has been insulated from other underground metal.

After an approximate current demand figure has been determined, a decision must be made regarding the type of current source to be employed: i.e., rectifiers or galvanic anodes or a combination of both. Many factors will necessarily influence this decision.

Some considerations regarding rectifiers for a current source are as follows:

1. In favor of rectifiers:
   a. Less maintenance due to fewer installations.
   b. Can be used in comparatively high resistance soils.
   c. Current output can be more easily controlled.
   d. Can operate for longer period of time before anode replacement is necessary.
2. Against rectifiers, the following factors are sometimes significant:
   a. Larger current concentration sometimes prohibits usage in congested underground areas.
   b. The distribution factor* is usually higher than with galvanic anodes.

Some of the considerations to be made when galvanic anodes are used for a current source are as follows:

1. In favor of magnesium or zinc anodes are:
   a. Lower current *distribution factor.**
   b. Less danger of interference to other underground systems.
2. Against the use of magnesium or zinc anodes, there are these factors:
   a. Must be placed within 10 ft of pipe to be protected. When piping is under pavement, installation cost is high.
   b. Use is limited to lower resistivity soils.
   c. Anodes must be replaced at least every 10 years. Average life of the anode is short in low resistance soils. For example, a 50-lb magnesium anode will generally last only six years in 300 ohm-cm soil.

***The distribution factor is defined as the ratio of total amperes of cathodic protection current from a source to the portion useful in maintaining cathodic protection. In any cathodic protection system, the areas nearest the anode or anodes receive an excess amount of protection in order to give areas removed from the anode minimum protection.**

• Economics of cathodic protection

In the final analysis, the choice between rectifiers and anodes for cathodic protection may be decided by economic considerations. That is, if the situation is such that either magnesium or zinc anodes, rectifiers, or a combination of both would do the job from a current demand standpoint.

The author uses an *equivalent uniform annual cost* method of comparison for cathodic protection economic studies. This method reduces annual costs to a percentage of original cost of equipment or structure.

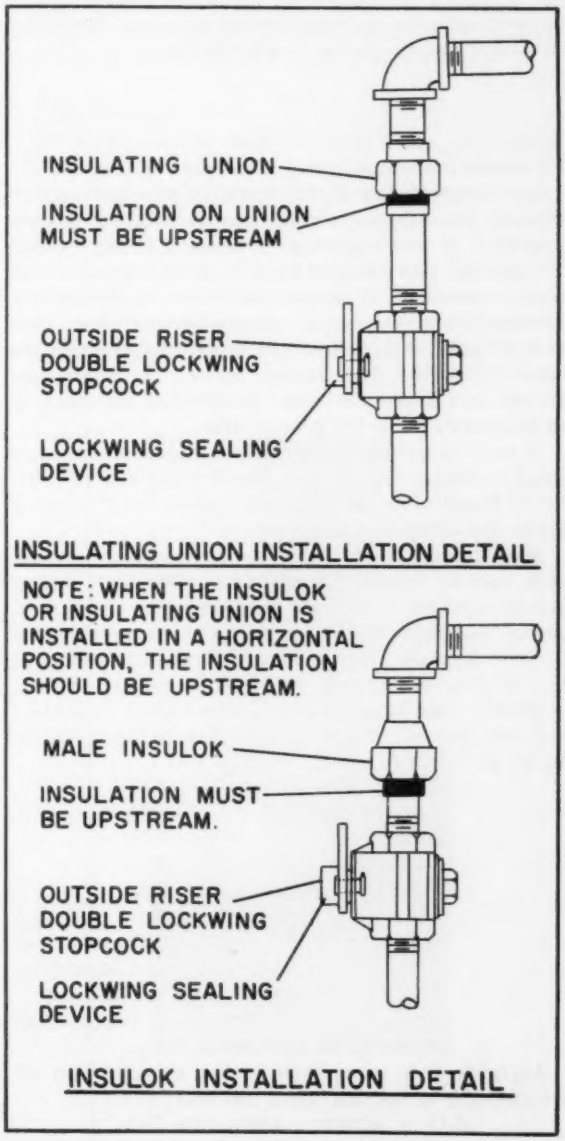

INSULATING UNION
INSULATION ON UNION MUST BE UPSTREAM
OUTSIDE RISER DOUBLE LOCKWING STOPCOCK
LOCKWING SEALING DEVICE
INSULATING UNION INSTALLATION DETAIL
NOTE: WHEN THE INSULOK OR INSULATING UNION IS INSTALLED IN A HORIZONTAL POSITION, THE INSULATION SHOULD BE UPSTREAM.
MALE INSULOK
INSULATION MUST BE UPSTREAM.
OUTSIDE RISER DOUBLE LOCKWING STOPCOCK
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Fig. 2. Insulating method.

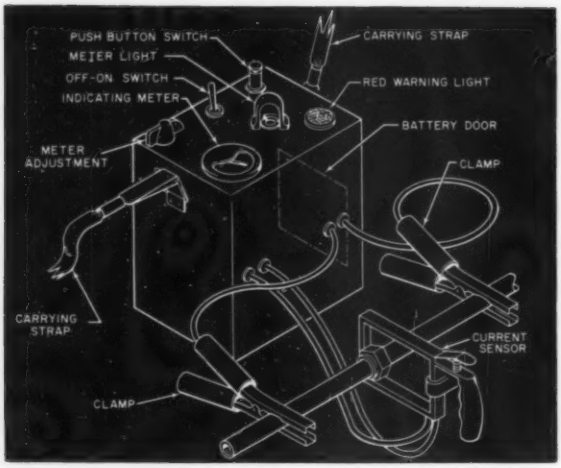


Fig. 3. Detail of battery-operated insulation tester used primarily to check service line insulators. A clamp device can be obtained to check insulators in lines up to 4-in. diameter.

The following example will illustrate the method.

It is found by means of computations and current demand tests that a certain gas distribution system or section of a system requires between 18 and 24 amp of cathodic protection current to gain complete, uniform protection. It is estimated that approximately 18 amp will be required if magnesium anodes are used and 24 amp if rectifiers are used. Experience has shown that the *distribution factor* for magnesium anodes is 1.5 and for small distributed rectifiers, 2, in most systems in the general area.

A cost comparison between magnesium anodes and small rectifiers is desired. The average soil resistivity is found to be 1000 ohm-cm. Some soil is slightly lower but other is higher.

Four locations are found where rectifier groundbeds can be installed away from "foreign" underground systems. It is decided that four 6-amp capacity rectifiers would be required to provide the current demand. Based on experience, the installed cost of four such rectifiers, groundbeds, and wiring, is $2200. This figure can be reduced to an *equivalent uniform annual cost*, so that a comparison can be made, as follows:

Cost of Money	0.07
Taxes & Insurance	0.02
Depreciation	0.06
*Power Cost	0.22
Operation & Maintenance	0.08
	0.45 = 45 per cent of original installed cost

*Varies widely depending on locality and ownership of electric facilities.

Applying this percentage to the original cost of the cathodic protection units, we find:

0.45 × $2200 = $990 equivalent uniform annual cost.

Based on manufacturers data, it is found that one magnesium anode will put out 0.160 amp in 1000 ohm-cm soil. To obtain the estimated 18 amp of current, roughly 115 magnesium anodes will be required. If these are 17-lb anodes, manufacturer's literature gives anode life as six years. The cost of the anodes is $12 per anode, and it is calculated that installation cost will be about $12 each. The total cost would then be $24 per anode or a total cost of $2760. To determine the *equivalent uniform annual cost* of the anodes installation, the following percentages will be used:

Fixed Charges (cost of money, taxes, insurance)	0.09
Operation & Maintenance	0.15
*Depreciation— Straight Line	0.17
	0.41 = 41 per cent of original installed cost.

*This will vary with anode output variations and cost of anode differences.

The *equivalent uniform annual cost* for the magnesium anodes would then be:

.41 × $2760 = $1131.60 equivalent uniform annual cost.

Comparing the two *equivalent uniform annual costs*, we find that magnesium anodes appear to be the most economical by:

$1131.60 — $990.00 = $141.60 per year.

In many cases where soil resistivities average 1000 ohm-cm, the cost of rectifiers versus magnesium anodes calculates to be almost equal. In soil with soil resistivities higher than the 1000 ohm-cm soil used for the illustration, economics generally favor rectifiers over galvanic anodes. The figures used for the illustration are valid for one situation only. They were used in this case only to illustrate the *equivalent uniform annual cost* method of comparison.

Of course, in many cases, it will be desirable to combine the use of galvanic anodes and rectifiers. For example, in commercial and shopping areas of a city, the stray current problem might indicate that magnesium or zinc anodes are preferable, while rectifiers are satisfactory in residential areas.

• Rectifier groundbeds

Recently, a great deal of attention has been given to "well-type" groundbeds for use in distribution systems. Trials have shown these to be highly satisfactory. In many cases, lower resistance soil can be found deeper. Also, current coming from a greater depth is more selective, thereby eliminating interference with other metal to a certain extent.

In many areas where heavy soil is encountered, a satisfactory vent must be provided for each verticle groundbed rod. *Fig. 4* illustrates a method used by Montana-Dakota. In this case, the plastic curb box acts as a vent, a marker, and an inlet through which water can be run to wet backfill when anode resistance becomes too high. This method has proven to be the only way groundbeds can be maintained in many of the dense compacted soils encountered.

• Stray current

Recent articles have gone into lengthy details regarding the stray current problem so that everyone connected with cathodic protection and anti-corrosion work will realize that there is this danger.

A company which installs cathodic protection on its gas mains has a moral obligation to see that cathodic current from its system does not seriously harm other systems. The perfect solution, of course, is to keep current densities low enough so that there are no stray current problems. Wherever stray current is encountered, suitable resistance bonds should be installed with representatives from all interested companies present.

Much stray current can be drained back to the gas system by use of resistance bonds installed around service line insulators. These bonds can be tagged suitably to insure permanence.

Stray current problems can grow so complex that it becomes necessary to enter into joint cathodic protection agreements with all underground metal owners concerned. Most large cities now have committees composed of representatives of all utilities concerned. The August 1959 issue of GAS Magazine contains an article dealing with corrosion prevention cooperation. The literature contains many such excellent articles which deal with the stray current problem.

As stated before, a gas distribution company which is applying cathodic protection to its system is obligated to insure, to the best of its ability, that stray current from its cathodic protection system will not harm other underground metallic systems. However, if it is impossible to eliminate all of the stray current effects, the other companies involved should be obligated to protect themselves. It is believed by the author that a gas company is *legally* entitled to apply cathodic protection to its system and is *morally* obligated to eliminate undesirable stray current effects from other underground systems, if possible.

• Cooperation and education

It has been stressed earlier that education is one of the most important phases of any anti-corrosion program. Through education, the cooperation of distribution system personnel is obtained. This wholehearted cooperation is absolutely necessary because most of the actual anti-corrosion installation and maintenance work is done by these men. First of all, the men must be sold on the overall program, then they must be convinced of the necessity of doing the work properly. Finally, they must be informed of the results of their work. This is a sales job which should be repeated frequently. It can be accomplished through a combination of schools, literature, a specifications manual, and on-the-job instructions.

• Conclusion

Corrosion can be stopped in any gas distribution system by the educated use of the tools available for this purpose. In some systems, the problems are much greater than in others, but so also are the benefits derived from a successful application of corrosion prevention measures. Sound engineering, testing, correct material application, proper installation, education, and cooperation are all necessities. The dividends gained will by far outweigh the investment. ■

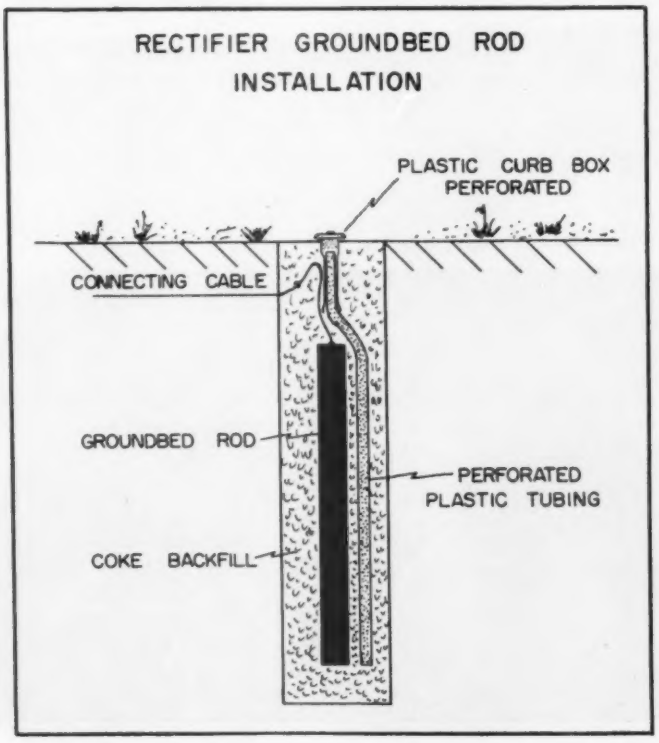
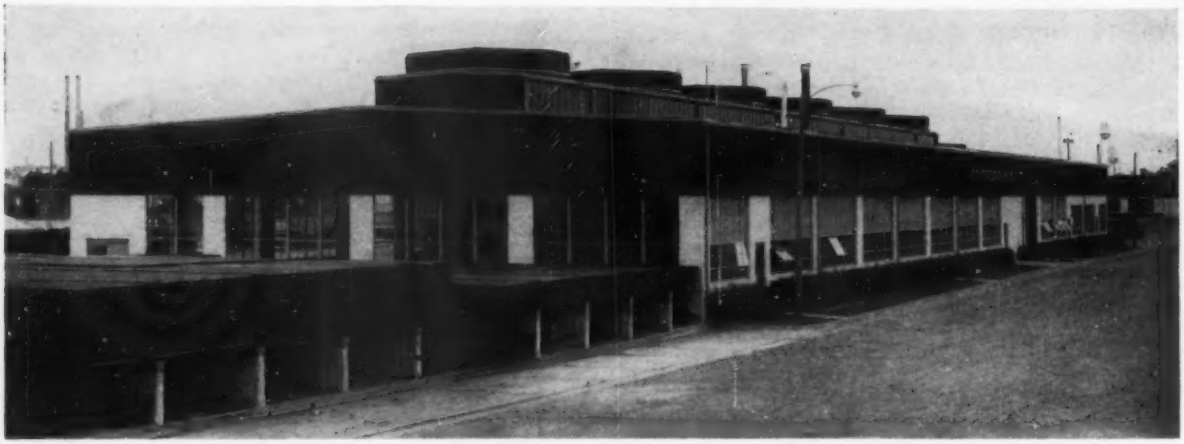


Fig. 4. At left is the groundbed rod installation. Above is a rectifier installation for distribution system cathodic protection.



Exterior of Memphis' pipe coating building. Coated pipe on racks is at north end of building.

CORROSION PREVENTION

Pace-setting plant operated in Memphis

Modern plant coats pipe

By D. C. BENSON, Superintendent, Gas Department
Memphis (Tenn.) Light, Gas & Water Division

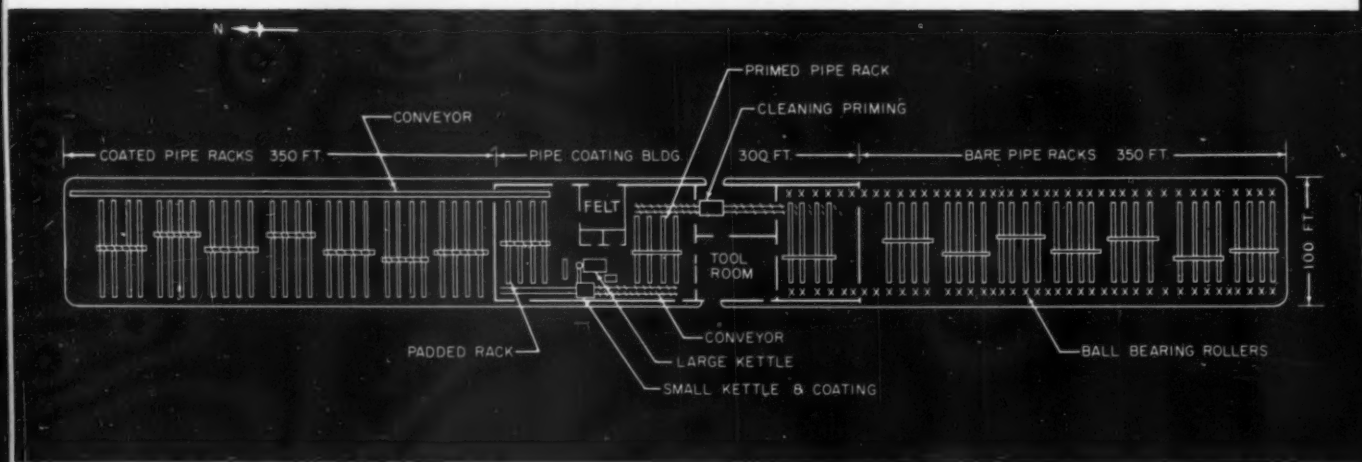
THE gas division of the Memphis Light, Gas and Water division of the City of Memphis, Tenn., is subdivided into engineering, operation and distribution departments. These are responsible for engineering, construction, maintenance and operation of the gas system. Other departments handle purchasing, accounting, collections, etc., which are common to gas, electricity and water.

Natural gas is distributed to all cities and towns in Shelby county—the largest county in Tennessee.

A pipe coating plant is operated by the gas distribution department. In 1950, the division purchased equipment to clean, coat and wrap all steel pipe for the system. Initially, this equipment was operated outdoors.

On March 8, 1954, the equipment was moved to a new gas service center, and a complete pipe coating building and yard was built. Our pipe yard occupies a space 100 ft by 1000 ft. The coating building, 82-ft wide by 302-ft long, is centered between seven

Layout of Memphis' pipe coating operation.



bare-pipe racks and seven coated-pipe racks. The building has concrete floors throughout; is of steel construction with walls of Robertson protected metal; and has steel sash windows and buff colored 8-in. facing tile.

Windows occupy most of the outside wall space on all sides of the building, making it a light and cool place to work (*Fig. 1*). Space is provided for storing a carload of felt. Coating and priming materials are stored outside and brought in as needed. Barrels are placed four on a pallet and handled by a fork-lift truck.

Pipe is delivered by rail or barge. Pipe arriving by barge is received at the city terminal on Presidents island. It is transferred to gondolas and delivered to our spur track adjacent to bare-pipe racks at the south end of the pipe coating building. Pipe is received and unloaded by the purchasing and stores department, using a Hydrocrane.

Seven racks are used for bare-pipe storage. These racks (see *Fig. 2*) were designed so pipe could be stacked without overloading any rack. They are made of reinforced concrete. Each rack consists of four truck-height supports spaced at 10 ft with 15 ft between racks. This spacing permits storage of pipe of 20-ft or 45-ft lengths. Each support has a bearing surface width of 10 in. Steel angles 4-in. x ⅜-in. x 4-in. form the edges of this surface the full rack length to prevent damage to the concrete. A ball-bearing roller is bolted to each end of each support and pedestals between supports to form a line of rollers, spaced at 5 ft, along each end of the racks and leading into the building. One man can easily move a 40-ft length of pipe from any rack to the cleaning machine.

Recently, we powered several of these rollers with individual fluid drive electric motors. This speeds moving pipe into the building. Pipe enters the building and is lifted onto a heating and drying rack by air-operated kicker arms. This rack can be loaded from either side. The pipe is heated by overhead ducts during winter months.

At present, two brush and scraper type cleaning machines (see *Fig. 3*) are used. The smaller machine cleans up to 10-in. and the larger machine from 12 to 26 in. Dust from the cleaning operation is collected by a Rotoclone. The Rotoclone was purchased with capacity to operate with pellet cleaning equipment.

It is planned to install pellet-type cleaning equipment which will have powered, skewed-disc rollers on the incoming and outgoing racks. The new machine will clean pipe of sizes 1 through 26 in., and will speed up our cleaning operation.

Cleaned and primed pipe is lifted, from the outgoing conveyor of the cleaning machine, by air-operated kicker arms onto the primed pipe rack. This rack is also reinforced concrete, but has a 0.125-in. wide bearing surface above a steel plate, along each support, to prevent damage to prime coats. From this rack primed pipe is rolled onto the incoming conveyor of the coating machine. We use a conveyor of our own design, fabricated in the division shops.

Our conveyor will handle 1 through 26-in. diameter pipe at controlled speeds. The powered rollers can be set for any size pipe and desired helix to give proper forward speed for the paper being used. Changes from one size pipe to another can be made in a few minutes (see *Fig. 4*).

Coating material is brought in as needed. A space is provided for breaking the product which is then

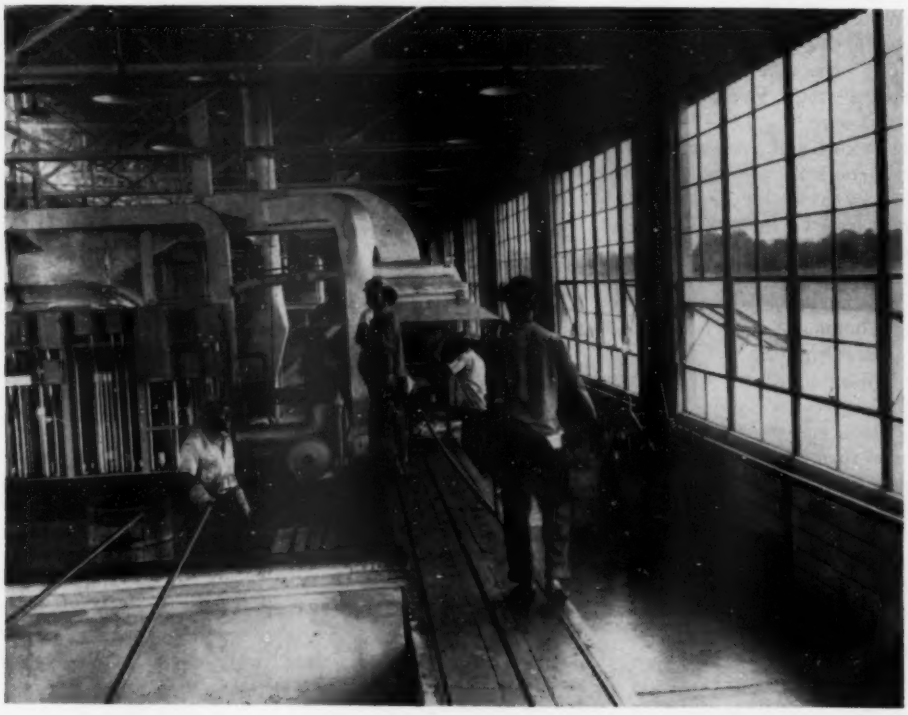


Fig. 1. One-inch coated and wrapped pipe comes out of coating and wrapping machine. Visible is the back of the control panel and the ductwork for burning smoke.

Fig. 2. Bare pipe racks at the south end of building.

loaded into the 20-bbl kettle by a belt conveyor. (See, again, *Fig. 4.*)

The large kettle is supported by steel columns and beams over a bricked-in gas-fired combustion chamber. Fumes and heat of the forced draft pass around the kettle and are drawn through a jacket around the shutoff valve and trough (through which heated enamel flows to the small kettle), then to a jacket around the smoke duct from the large kettle (see *Fig. 1*). This heats the smoke which then passes through a duct to a smoke-burning fire box. This box is a small combustion chamber with four burners. Smoke from the canopy over the small kettle is also drawn through these burners. The residue from the burner box is vented through the roof. This system is very efficient. The ceiling over the kettle—originally painted white—is still a cream color after five years of operation.

The burner under the large kettle, the one under the small kettle, and the four burners in the smoke burning box, are all controlled by a Flame-Trol safety-combustion system. Burners can be lighted and controlled from one control panel. Recording charts monitor the temperature of material in each kettle.

A 3/32-in. coating of coal-tar based enamel is applied at manufacturer's recommended temperature and wrapped with 15-lb felt. Coating is checked for holidays by a Tinker & Rasor holiday detector.

Coated and wrapped pipe is placed on a rack padded with 10-in. wide x 1.25-in. thick rubber strips the full length of all four supports forming the rack. The coating cools and sets while pipe is on the rack. Coated pipe is rolled onto the conveyor to the outside storage racks.

This conveyor was fabricated by Anchor to our specifications (see *Fig. 5*). Our conveyor is 405 ft long and runs along the east end of the seven coated-pipe racks at the north end of the building. It has a variable speed drive, 1 ft to 50 ft per minute, and is reversible. Supports for the pipe are 4 in. x 4 in. x 2 ft-6 in. oak spaced at 5 ft on centers. Supports are sloped to center to prevent free rolling of the pipe. Start, stop and reverse control buttons are located between each rack for complete control at all times.

Fig. 3. The cleaning room at this time has two cleaning machines. Dust collector is in center of photo.

When handling small size pipe, the conveyor is loaded while stopped and moved forward for unloading. Larger sizes of pipe are rolled on and off while the conveyor is in motion. Ends of the outside racks have rubber pads to prevent damage to the coating.

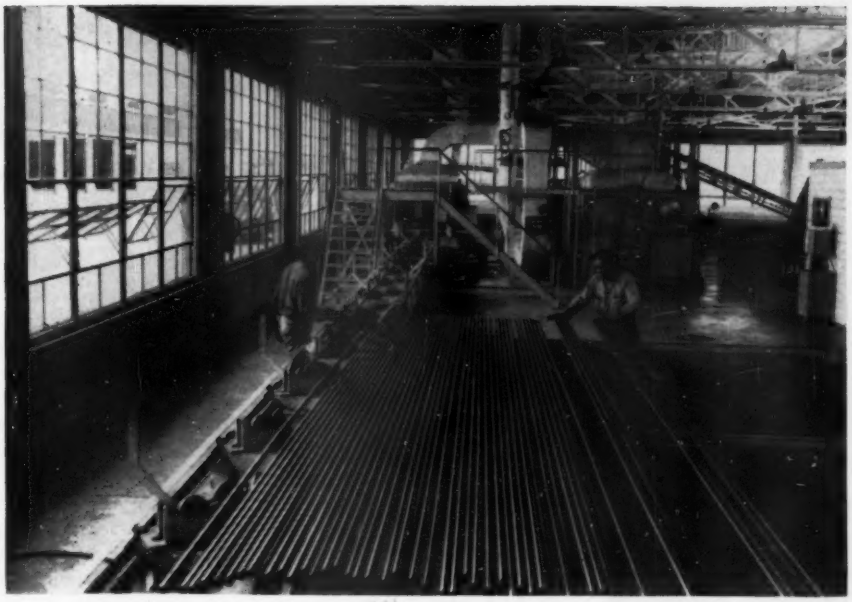


Fig. 4. Incoming rack to coating machine. Primed pipe rack is in foreground. Belt conveyor is for loading large kettle.

Stacking pipe is done with a crane. Boards 1 in. x 6 in. are used to form ample bearing surface between layers.

Loading of trucks is done by crane or, for small pipe, by hand.

Very few changes have been made in our original layout of the plant. Many layouts were made and analyzed before the one in use was finalized.

Initial start-up of the coating plant was in January 1954. Since then, and through April 1959, a total of 5,777,652 lineal feet of pipe, sizes 1- through 30-in., has been coated and wrapped. Of this amount:

2,546,264 ft was 1-in.
1,836,866 ft was 2-in.
454,273 ft was 4-in.
36,867 ft was 16-in.
22,707 ft was 20-in.
44,893 ft was 22-in.

The remainder was of various sizes and amounts.

The cost of coating pipe in our plant is comparatively low. The plant crew is a foreman and 20 laborers. The plant is not in continuous operation. It is only operated to provide a stock of coated and wrapped pipe for a few months' requirements. When the plant is not operating, the crew is assigned to other work. ■

Mr. Benson extends a cordial invitation to gas people who are interested to visit the coating and wrapping plant in Memphis.

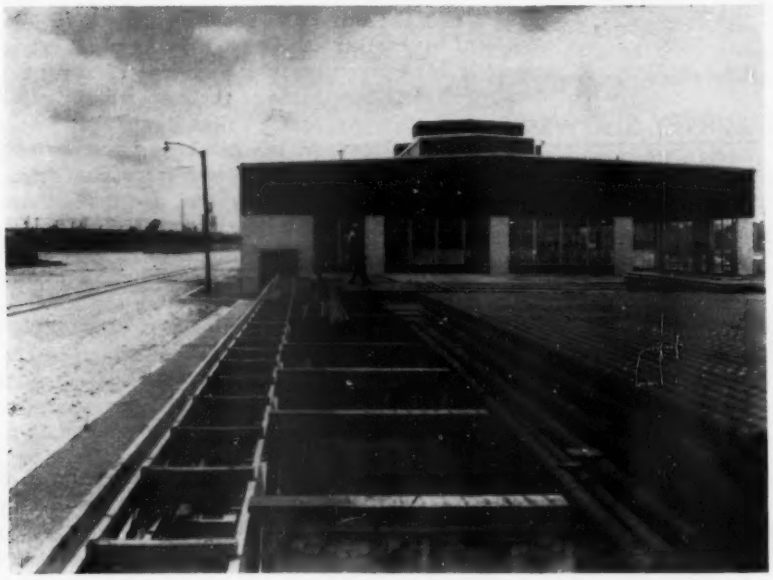
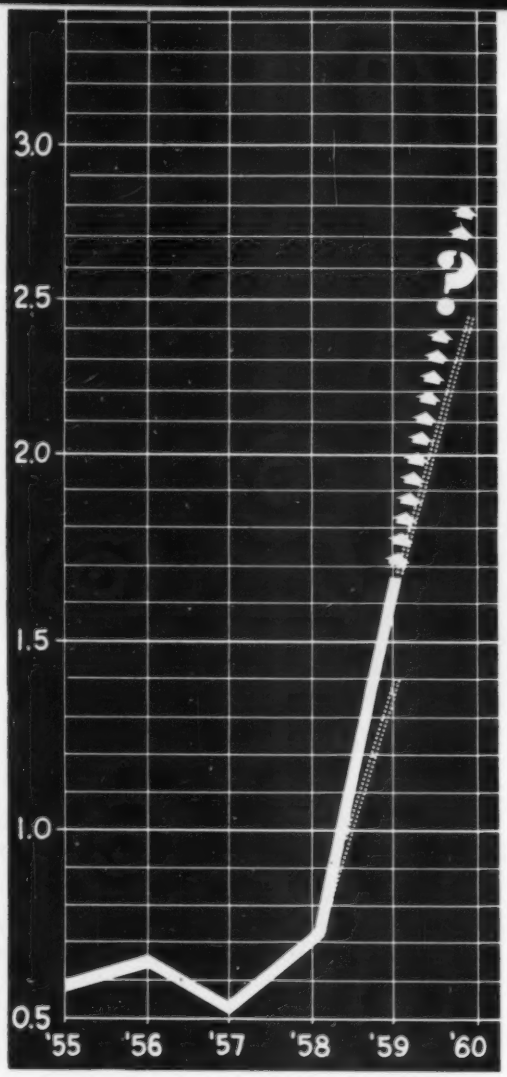


Fig. 5. Coated pipe racks at north end of building. Conveyor was built to Memphis specifications. Note rubber pads on ends of racks.



The spectacular growth in plastics pipe usage is shown in this chart (all figures in millions of feet). After 0.72 million ft in 1958, users estimated (lower double dotted line) they'd use 1.4 million ft, but actually used 1.66 million ft. They now estimate (upper double dotted line) 1960 usage at 2.46 million ft. But if they are being as conservative as they were last year, 1960 usage could soar (arrows and question mark) to 2.80 million ft!

And look at the youngster's growth chart! Perhaps the industry can start measuring plastics pipe in miles, not feet!

PLASTICS PIPE

1960 PLASTICS PIPE SURVEY SHOWS:

The infant is becoming a child

By ROBERT CLAY • Managing Editor

GAS Magazine's first plastics pipe survey was conducted in 1952. Although six companies were either using or experimenting with it, the general reaction seemed to be "Plastics pipe—what's that?" When the second survey (1954) showed significant growth in both usage and interest, it became an annual project.

Despite increasing usage totals that have—on at least one occasion—doubled within a one-year period, many gas industry men have placed plastics pipe in perspective by retorting "They're still measuring it in feet, aren't they?"

These men, of course, are right. While plastics pipe usage has grown by leaps and bounds, it is still barely out of its infancy. But, as the infant is one day measured in feet instead of inches, it appears that we can now begin to measure plastics pipe in miles, not feet.

As you read this, the gas industry should have its 2000th mile of plastics pipe in the ground. By the end of this year, the total should be up to 2422 miles. The average plastics pipe user expects to put in 51,342 ft or 9.7 miles this year. Thus, it appears that this year, the first in those much ballyhooed Golden Sixties, might be a good time to begin thinking of plastics pipe in terms of miles. Accordingly mileages have been quoted for some of the larger footages that appear on these pages.

For this Eighth Annual Plastics Pipe Survey, questionnaires went to nearly 400 distribution companies. The industry's interest in plastics pipe was evident from the way it responded. More than 57 per cent of the companies returned the form, an extraordinarily high percentage for any type of survey.

Nearly two-thirds of the responding companies still said "No, we aren't using it and have no plans to start." However, the number of companies that are using or experimenting with it went up from 44 (last year) to 69, a 57 per cent increase. Another five companies were definitely considering experimenting with it.

Of the 69 companies responding, 67 quoted figures. Of course, not all questions were applicable—or were answered by—all companies. The story these answers wove is told in see-at-a-glance fashion in the accompanying graphs, charts, and panels. It is a heart-warming story for the plastics pipe people.

After hovering around the 0.6 million ft mark for three years, annual usage rose not very steeply to 0.7 million ft in 1958. Then, in the 1959 survey, the responding companies indicated they'd use 1.4 million ft, nearly twice the previous year's total. The 1960 survey found that this estimate was actually

The Plastics Pipe Picture at a Glance

8,666,719 ft (1641 miles) in the ground on January 1, 1959.

That's an average of 146,893 ft for the 59 companies responding. The median company had 5280 ft.

1,660,137 ft (314 miles) laid during 1959.

A 14 per cent increase over the estimate made in the 1959 survey. That's an average of 40,491 ft for the 41 companies responding. The median company laid 5,000 ft.

10,326,856 ft (1955 miles) in the ground on January 1, 1960.

That's an average of 163,918 ft for the 63 companies responding. The median company had 6,502 ft.

2,464,440 ft (467 miles) expected to be laid during 1960.

A 76 per cent increase over the '59 forecast, a 48 per cent increase over '59 usage. That's an average of 51,342 ft for the 48 companies responding. The median company expects to lay 6,594 ft.

12,791,296 (2422 miles) expected to be in the ground on January 1, 1961.

That's an average of 203,036 ft for the 67 companies responding. The median company expects to have 11,780 ft.

conservative, for 1959 usage was 14 per cent above that figure, or 1.66 million ft (314 miles). Should that conservatism be present in the companies' 1960 estimates, the expected 2.46 million ft (467 miles) would turn out to be 2.8 million ft, or over 530 miles!

The plastics pipe actually in the ground rose from 1641 miles at the beginning of 1959 to 1955 miles at the beginning of 1960. And the industry estimates that figure will go up to 2422 miles by the end of this year. At the same time, the in-ground footage of the average plastics pipe user rose from 146,893 ft at the beginning of 1959 to 163,918 ft last Jan. 1. During 1960, that average is expected to go up to 203,036 ft. The averages, however, have been warped out of shape by a few companies using very large amounts. A more accurate picture of the typical user is given by the median. The median companies' footages, while much smaller, will more than double in the two years ending Jan. 1, 1961, rising from 5280 ft to 11,780 ft.

How is this pipe used? Nearly half of last year's 1,660,137 ft, or 789,423 ft, was for replacing or inserting in existing services. New services accounted for 450,851 ft, a majority of the remainder. Twenty-seven companies used it for existing services, 25 for new services. New plastics mains, on the other hand, were used by only 12 companies and only five experimented with plastics for replacing or inserting in existing mains. However, as the accompanying panel shows, the footage per company was higher for new mains than for any other use. In 1959, the average user laid 29,511 ft of new mains, the median company, 6629 ft.

The biggest single user of plastics pipe continues to be Southern California Gas Co., although it has not used any for five years. The company installed 3,295,000 ft between 1945 and 1955 and presumably has no further plans for plastics pipe until it passes the test of time.

Coming up fast are two very active users. Southwest Gas Corp. of Las Vegas is now in second place with 2,400,000 ft. Closely following is Peoples Gas Light & Coke Co. of Chicago with 2,381,649 ft. Since Peoples expects to put in 600,000 ft (largest single '60 usage) as compared to Southwest's 500,000 ft, the two positions will apparently be reversed at year's end. At their present rate, both companies will pass SoCal in mid-'61 and will continue to far outdistance the field.

There are, however, a pair of fast-moving challengers in Arizona. In Phoenix, Arizona Public Service Co. is more than quadrupling its usage, from

HERE'S HOW PLASTICS PIPE WAS USED IN '59

For New Services—450,851 ft.

That's an average of 18,034 ft for the 25 companies responding. The median company used 4500 ft.

For Replacement of, or Insertion in, Existing Services —789,423 ft.

That's an average of 29,238 ft for the 27 companies responding. The median company used 2977 ft.

For New Mains—354,139 ft.

That's an average of 29,511 ft for the 12 companies responding. The median company used 6629 ft.

For Replacement of, or Insertion in, Existing Mains— 1,874 ft.

That's an average of 375 ft for the 5 companies responding. The median company used 400 ft.

THE TOP 25 PLASTICS PIPE USERS

• Their Past and Projected Usage

Company	Up to Jan. 1, '60 (ft)	During '59 (incld. in 1st col.) (ft)	'60 Estimate (ft)	M. O. P. (psi)
Arizona Public Serv. Co. (Phoenix)	170,000	120,000	500,000	60
Arkansas-Missouri Power (Blytheville, Ark.)	38,000	13,000	10–15,000	50
Central Electric & Gas (Lincoln, Neb.)	31,000	11,500	12,000	20
Gas Service Co. (Kansas City, Mo.)	62,224	16,224	12–18,000	50
Illinois Power Co. (Decatur)	55,200	45,200	60,000	5
Kansas Power & Light Co. (Salina)	45,900	10,400	10,400	30
London Gas Co., Inc. (London, Ky.)	19,100	4,100	4,100	25
Lone Star Gas Co. (Dallas)	90,000	10,000	10,000	50
Louisville Gas & Electric	24,000	0	0	25
Mississippi Valley Gas Co. (Jackson, Miss.)	28,457	457	200	15
Mountain Fuel Supply Co. (Salt Lake City, Utah)	30,000	0	0	50
Pacific Gas & Electric Co. (San Francisco)	93,000	7,000	10,000	50
City of Palo Alto (Palo Alto, Calif.)	163,789	54,796	54,796	25
Peoples Gas Light & Coke Co. (Chicago)	2,381,649	597,969	600,000	20
Peoples Natural Gas Co. (Omaha, Neb.)	0	0	50,000	0
Public Service Co. of Colorado (Denver)	822,000	200,000	200,000	15
Pueblo Gas & Fuel Co. (Pueblo, Colo.)	26,323	9,309	10,000	15
Sierra Pacific Power Co. (Reno)	34,000	24,000	20,000	20
Southern Calif. Gas Co. (Los Angeles)	3,295,000	0		55
Southwest Gas Corp. (Las Vegas)	2,400,000	400,000	500,000	50
Tidewater Natural Gas Co. (Wilmington, N. C.)	5,000	5,000	90,000	50
Tucson Gas & Electric Co.	152,000	55,000	150,000	40
United Gas Corp. (Houston)	18,297	6,689	6,689	60
Vancouver Island Gas Co. (Naniamo, B. C.)	8,500	7,000	10–15,000	17
Western Gas Service Co. (Ysleta, Tex.)	185,000	25,000	50,000	50

• Their '59 Usage Analyzed

New Services (ft)	Existing Service replacement or insertion (ft)	New Mains (ft)	Existing Mains replacement or insertion (ft)	Chemical and/or trade name(s) of product(s) used
60,000	20,000	40,000	0	ABS I, ABS II; PVC
6,000	0	7,000	0	Polyethylene; Carlon
1,500	8,600	1,000	400	High Density — High Molecular Weight Polyethylene; Orangeburg SPHD
8,340	7,884	0	0	High Impact Polyvinyl Chloride Type II; Kraloy
28,000	17,200	0	0	PVC; Kraloy
0	10,400	0	0	Butyrate; Tenite II
1,000	0	2,900	200	Kralastic
0	10,000	0	0	Tenite II
0	0	0	0	—
446	11	0	0	Tenite II; Cellulose Acetate Butyrate; Republic Semi-Rigid Type B
0	0	0	0	—
7,000	0	0	0	Styrene-Acrylonitrile; Kralastic
14,592	23,024	17,180	0	ABS, CAB; Kralastic; Cycolac; Tenite II
9,500	588,469	0	0	Cellulose Acetate Butyrate; Tenite II
0	0	0	0	—
86,500	54,500	0	0	Cellulose Acetate Butyrate; Tenite II
1,408	7,901	0	0	Butyrate; Tenite II
5,000	19,000	0	0	PVC; Kraloy
0	0	0	0	—
200,000	0	200,000	0	PVC
5,000	0	0	0	PVC
4,500	1,500	49,000	0	Kralastic
430	0	6,259	0	Polyvinyl Chloride PVC
7,000	0	0	0	Styrene Acrylonitrile Resin Rubber Blend; Kralastic
1,000	0	24,000	0	Styrene Acrylonitrile; Kralastic

120,000 ft in '59 to 500,000 ft in '60. And Tucson Gas & Electric Co. is nearly tripling its usage, from 55,000 to 150,000 ft.

There are also some bright newcomers. One year ago, Tidewater Natural Gas Co. of Wilmington, N.C. had used no plastics pipe. It put in 5000 ft last year, now plans on using 90,000 in 1960. And in Omaha, Neb., Peoples Natural Gas Co. has not used any yet, but is jumping right in with 50,000 ft in '60.

The fact is that there are not many bright newcomers. Of the nearly 400 companies that received the survey, only five answered that they intended to start using plastics pipe this year. On the other hand, 18 are increasing their rate of installation in '60. Twenty-five will continue at the same rate.

Is plastics pipe successful from an operating point of view? "Yes!" said 41 of the 69 users. Only three replied negatively. Most of the others felt their experience was still too limited to provide a conclusion.

What is the maximum operating pressure under which plastics pipe operates so successfully? Answers varied from 6 in. w.c. to 200 psi. The average maximum turned out to be 33 psi, while the median maximum was 25 psi.

Do these companies have any plans for other plastics items, such as valves, etc.? Only six answered affirmatively, indicating that there is very little thinking in that direction at this point. That may change, however, now that the tiny infant has grown into a child.

It's much too soon for any thoughts as to how large the child will grow. But perhaps 1960 will be remembered as the year we were able to start measuring plastics pipe in miles, not feet! ■

69 REPORTING UTILITIES USE PLASTICS PIPE

OPERATIONAL LENGTH USERS: (Over 5000 Ft.)

Arizona Public Service Co., Phoenix, Ariz.
Arkansas-Missouri Power Co., Blytheville, Ark.
Associated Natural Gas Co., Blytheville, Ark.
Central Electric & Gas Co., Lincoln, Neb.
Central Indiana Gas Co., Muncie, Ind.
Cheyenne Light, Fuel & Power Co., Cheyenne, Wyo.
City Utilities of Springfield, Springfield, Mo.
Cons. Edison Co. of New York, Inc., New York*
Florida Public Utilities Co., West Palm Beach, Fla.
Gas Service Co., Kansas City, Mo.
Illinois Power Co., Decatur, Ill.
Kansas Power & Light Co., Salina, Kan.
London Gas Co., Inc., London, Ky.
Lone Star Gas Co., Dallas
Louisville Gas & Electric Co., Louisville, Ky.
MidSouth Gas Co., Little Rock
Milwaukee Gas Light Co., Milwaukee
Minneapolis Gas Co., Minneapolis
Mississippi Valley Gas Co., Jackson, Miss.
Mountain Fuel Supply Co., Salt Lake City
New Orleans Public Service, New Orleans
Northern Indiana Public Service, Hammond, Ind.
Pacific Gas & Electric Co., San Francisco
Palo Alto Water-Gas Service Dept., Palo Alto, California
Peoples Gas Light & Coke Co., Chicago
Peoples Natural Gas, Omaha*
Peoples Natural Gas Co., Pittsburgh, Pa.
Philadelphia Gas Works (Div. UGI), Philadelphia
Public Service Co. of Colorado, Denver
Pueblo Gas & Fuel Co., Pueblo, Colo.
Rio Grande Valley Gas Co., Brownsville, Tex.
Sierra Pacific Power Co., Reno, Nev.
Southern California Gas Co., Los Angeles
Southwest Gas Corp., Las Vegas, Nev.
Tidewater Natural Gas., Wilmington, N.C.
Tucson Gas & Electric Co., Tucson, Ariz.
United Gas Corp., Houston
Vancouver Island Gas Co., Ltd., Nanaimo, B.C.
Western Gas Service Co., Ysleta, Tex.
Wisconsin Public Service Corp., Oshkosh, Wis.

EXPERIMENTAL LENGTH USERS: (Under 5000 Ft.)

Alabama Gas Corp., Birmingham
Arkansas-Western Gas Co., Fayetteville, Ark.
Brazos River Gas Co., Mineral Wells, Texas
Bridgeport Gas Co., Bridgeport, Conn.
Brooklyn Union Gas Co., Brooklyn
Godfrey L. Cabot, Inc., Charleston, W. Va.
Central Louisiana Electric, Alexandria, La.
Cincinnati Gas & Electric Co., Cincinnati
Consolidated Gas Utility Corp., Wichita, Kan.
Gas Utilities Co., Robinson, Ill.*
Greenfield Gas Co., Inc., Greenfield, Ind.*
Iowa Power & Light Company, Des Moines*
Long Beach Gas Department, Long Beach, Calif.
Michigan Consolidated Gas Co., Detroit
Mobile Gas Service Corp., Mobile, Ala.*
Northwestern Public Service Co., Huron, S.D.
Northwestern Utilities, Ltd., Edmonton, Alta.
Northwest Natural Gas Co., Portland, Ore.
Ohio Fuel Gas Co., Columbus, Ohio
Orange & Rockland Utilities, Inc., Nyack, N.Y.
Philadelphia Electric Co., Philadelphia
San Diego Gas & Electric Co., San Diego, Calif.
Southern Union Gas Co., Dallas
Texas Southeastern Gas Co., Belleville, Texas
Union Gas Systems, Inc., Independence, Kan.
United Fuel Gas Co., Charleston, W. Va.
Washington Gas Light Co., Washington, D.C.
Western Kentucky Gas Co., Owensboro, Ky.
Wyoming Gas Co., Basin, Wyo.

* Will enter this category during 1960

PLASTICS PIPE

Positive answers' result in choice

PLASTICS PIPE helps Gila Bend get gas

By EARL M. JORGENSEN, Manager, Gas Operations
Arizona Public Service Co., Phoenix

MANAGEMENT'S decision to serve gas to Gila Bend, Ariz., was not a sudden spur-of-the-moment or middle-of-the-night thing.

Gila Bend is a small town setting astride a main highway junction and a section point on a mainline railroad. It also is headquarters for Bureau of Reclamation forces building the "Painted Rock" dam. Normally, it is the center or headquarters for one of the West's largest farming syndicates.

Some of the gas facts involved at the time of study were:

- 681 potential customers
- $51,440 estimated annual revenue
- 120,000 ft feeder (supply) line required
- 83,000 ft distribution line estimated

It became quite apparent from the economics that first costs must be kept to a minimum and the distribution design premised on costs, rather than ideal gas operating and engineering precepts. To this end, maximum supply pressures for minimum pipe diameters was the primary assumption. In an effort to make maximum savings, the material involved was studied and at this point plastics entered the consideration. In certain pipe sizes, and where operating conditions allowed, plastics pipe—as a material—costs less. It was further estimated that the installation of this piping could show a labor savings. This saving was further enlarged because Gila Bend was a "remote" area and would require crew subsistence and overtime labor.

It was then time for us to determine what we know about plastics pipe. Use of plastics pipe for natural gas distribution by Arizona Public Service Co. has been very limited until 1959.

Our company had been using plastics for service re-liners and, in one or two locations, had installed a number of straight plastics services off of steel distribution mains. So, we had a limited working knowledge of its use.

Two gas distributing company neighbors, Tucson Gas & Electric Co. and Southwest Gas Corp. (Las Vegas, Nev.), have been having considerable success with installation of "all" plastics distribution systems. There, many of our questions or doubts could be readily answered.

We felt we should find out for ourselves if plastics pipe for gas distribution is an acceptable substitute for steel as currently used and installed. A long hazardous road has brought gas distribution methods to the present techniques and practices. Certainly we have no idea of abandoning this experience without considerably more experience and knowledge of plastics.

This writer has read and studied many reports and manufacturers' brochures. Although there are numerous statements of satisfactory use of plastics, it will only be an "in use" or underground history that will finally give such piping "full status" in underground distribution of natural gas.

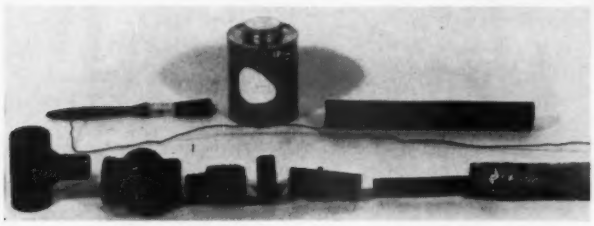
To repeat the lists of plastics and their physical and chemical characteristics would only duplicate many fine reports. Plastics in the three or four formulations now available, because they are economically feasible and physically capable of being extruded into pipe under currently available methods, must be considered for distribution use. It can be inferred here that somewhere along the line a better plastics material for pipe will be formulated and extruded—this is progress.

The problem, then, resolves itself into determining from an equation of known facts and requirements to be met, how well plastics meet these factors. The difference must be considered as a calculated risk worthy of being undertaken.

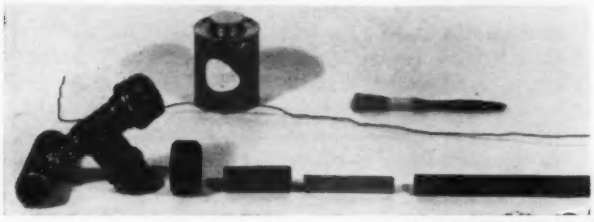
The equation is not easily solved by mathematical manipulations. But, there are enough positive answers on the plastics side to make it worthy of serious consideration. This decision is further justified by an estimate of cost for the specified job. *Fig. 1* shows

Text continues on page 85

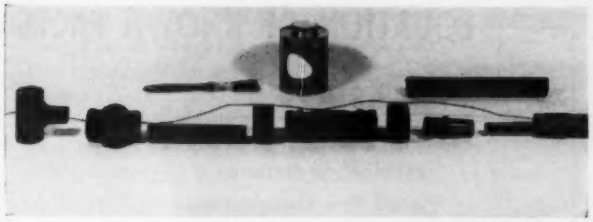
Detail photos show current methods for utilizing plastics pipe for gas service lines.



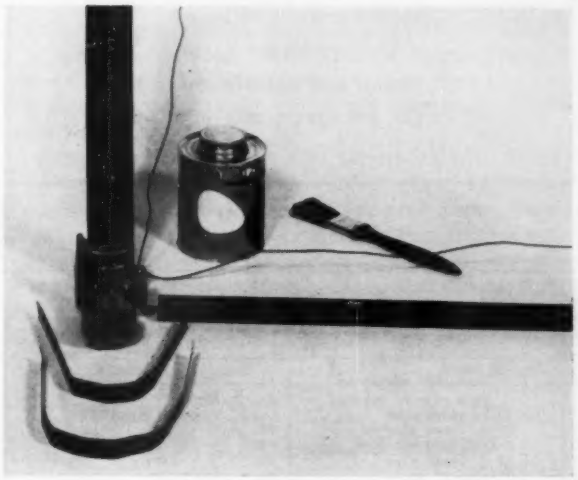
1. Steel main to plastics service using roundway stopcock with special compression fitting reducing 0.75- or 0.50-in.



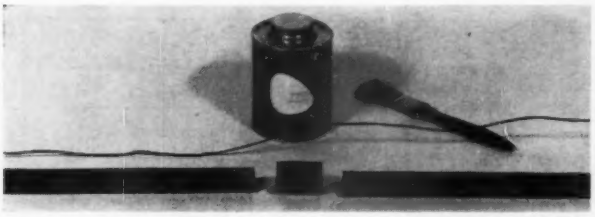
2. Steel main to plastics service using service tee incorporating compression connector for 0.75- or 0.50-in. plastics pipe.

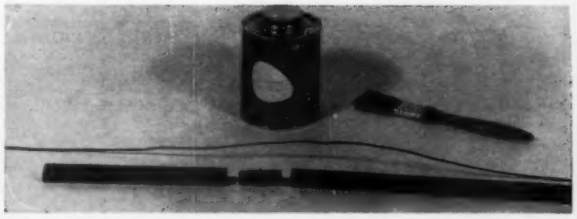


3. Steel main to plastics service using roundway stopcock and full compression coupling adapting from 0.75-in. steel to 0.75- or 0.50-in. plastics pipe.

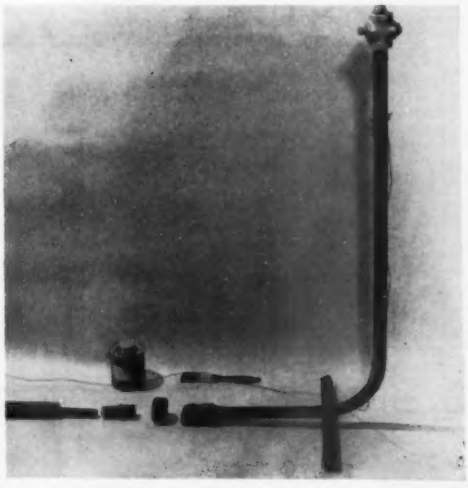


4. Plastics main to service of plastics using plastics tapping tee. Shown are band clamps which are used so that assembly and tapping can go on immediately without any delay in job progress.





5. & 6. These two photos illustrate the plastics couplings joining two lengths of plastics pipe, one external and the other internal, the latter being used for plastics inserted in old steel mains.



7. Steel riser from either inserted plastics or for full size plastics service. In this photo, one-half of a compression coupling has been welded to steel riser.

Throughout these photos may be seen the tracer wire laid contiguous with all plastics pipe. This wire is brought up at each service, where a direct connection to a pipe finder transmitter may be made. Our experience to date has proven this wire adequate for locating buried plastics pipe.

EQUATION OF KNOWN FACTS AND REQUIREMENTS TO BE MET

PLASTICS

resistant to corrosion
good flow characteristics
lower first costs
savings in construction
suitable distribution pipe sizes
light weight
limited pressure rating
difficult to locate
fittings and appurtenances are
not yet comparable with pipe

STEEL

33-1/3-yr life
safe operation
proper control
practical operating pressure range
predictable history
meets all sizes & capacity needs
full complement of tools & fittings
traceable
acceptable economics

FORM NO. 9162 3000 10-58 SWL

DETAILED ESTIMATE OF COST
Property Additions and Sundry Accounts

PE No. 7487 WA No.

ACCT. NO.	ITEM	UNIT	UNIT COST (EST.)	QUANTITY: EST. NO. OF UNITS	ACTUAL UNITS: PER FOREMAN	ACTUAL UNITS: PER BOOKS	ACTUAL UNITS: BOOKS OVER EST	PROPERTY ADDITIONS COST: ESTIMATED: ITEM COST	ESTIMATED: ADDITIONS	ACTUAL: PER BOOKS	ACTUAL: BOOKS OVER EST
1359	Gas Mains								80,288	948/9	
	4" bare pipe w/coating	Ft.	.79	2240		2240		1770		2307	
	3" bare pipe w/ coating	Ft.	.63	5975		8274		3764		6454	
	3" C. steel pipe	Ft.	.79	1600				1264			
	2" C. steel pipe	ft.	.51	15190		14720		7747		7509	
	1-1/4" C. steel pipe	Ft.	.34	28895		34202		9823		11427	
	6" C. Steel pipe	Ft.	2.55	200		331		510		811	
	2" plastic pipe	Ft.	.304	9540		12000		2900		3328	
	1-1/4" plastic pipe	Ft.	.194	19560		20,800		3795		3581	
	4" weld/wrap	Job						151			
	3" weld/wrap	Job						237			
	2" weld/wrap	Job					Misc.	494			
	6" weld/wrap	Job						450			
	3" lube valve	ea.	20.51	3		13		62		151	
	2" lube valve	ea.	12	1		4		12		54	
	3" weld flange	ea.	5.13	6		2		31		10	
	2" weld flange	ea.	3.26	2		12		7		39	
	2" R/W stopcock	ea.	7.92	4			Misc.	32			
	2" S/W stopcock	ea.	4.60	6		6		28		28	
	1-1/4" R/W stopcock	ea.	4.68	14			Misc.	66			
	1-1/4" S/W stopcock	ea.	2.86	20		12		57		26	
	2" plastic external cpl.	ea.	.541	601				325			
	1-1/4" plastic external cpl.	ea.	.340	980				333			
	2" plastic ells (90°)	ea.	1.04	5				5		6953	
	1-1/4" plastic ells (90°)	ea.	.68	5				3			
	2" plastic tees	ea.	1.20	18				22			
	1-1/4" plastic tees	ea.	.87	6			Misc.	5			
	2" x 1-1/4" Reducer bushing	ea.	.42	18				8			
	2" plastic caps	ea.	.42	4				2			
	1-1/4" plastic caps	ea.	.35	25				9			
	plastic cement	Job						100			
	R.R. casing material	Ft.	2.55	320				150			
	6" valve box	ea.	18	3		10		54		214	
	2" dresser cpl - Style 90	ea.	3.65	10		8		37			
	1-1/4" dresser cpl " "	ea.	2.78	17		16		47		75	
	Cathodic Protection	Job						120			
	Misc. Materials	Job						100			
	M. & S. Loading						Misc.	1139			
	6 Anode									63	
	Labor	Job						26252			
	P R Loading							3938		23/49	
	Transportation							5250		7322	
	Subsistence							9188		6142	
	Contract Labor									18176	
1360	Pumping & Regulating Equip								1450	1450	
	3/4" HPC Reg. Std. Dwg. 86812A	Job	200	6				1200			
	1" HPC Reg. Std Dwg. 86812A	Job	200	1				250			
	# Charges to Appropriate Blanket W. A. or Oper. Acct. — TOTAL										
	TOTAL (Exc'l. # Charged to Blanket W. A.'s)										
	TOTAL COST CHARGEABLE TO THIS W. A. { Property additions plus Sundry Accounts, plus Removal Cost, minus Salvage Value. } $										

Work Started _____ 19____ Work Completed _____ 19____ Placed in Service _____ 19____

By _____ Foreman Date _____ 19____ Plant Acc'ng Dept. Cost Analysis - By _____ Date _____ 19____

Fig. 1. Specific estimate of construction cost for actual combination steel and plastics distribution system installed in Gila Bend, according to Fig. 2 (below).

FIGURE 2.

	Total mains in feet
6-in. main	320
4-in. main	2,240
3-in. main	7,575
2-in. steel main	15,190
2-in. plastics main	9,540
1½-in. plastics main	19,560
1¼-in. steel main	29,560
Meters	781

the specific estimate of construction cost for the actual combination steel and plastics distribution system installed in Gila Bend according to *Fig. 2*.

It should be explained here that steel pipe was used for a "backbone" in Gila Bend for the future possibility of having to carry gas on past Gila Bend townsite to certain gas loads which may develop. Further, in order to operate at maximum pressures, steel pipe was desirable.

The "typed" figures on *Fig. 1* indicate estimated amounts and the "script" figures indicate actual amounts and costs incurred. An analysis of these figures indicates a very good estimate and a close approach of actual to estimated.

Now, in comparison, *Fig. 3* is the estimated cost to construct a similar "estimated" system using all coated steel pipe. By comparison with the original estimate (*Fig. 1*), the use of the plastics indicated a saving of about $17,000. Although the actual expended money is also over the estimated, there was about 8000 ft of additional pipe installed over that estimated, and would indicate a saving closer to $14,000 for the job, which is about 14 per cent on the larger or "all steel" amount.

Having made the decision to install plastics pipe, a set of procedures or practices must be established for the installation. Accompanying this article is a preliminary addition to Arizona Public Service Co.'s "Standard Practices" for the immediate purpose of guiding the installation of plastics pipe in Gila Bend. (It should be pointed out that upon making the decision to use plastics pipe, a committee was established, one engineer and one operating supervisor, to continually revise and advise on the accepted practices. At the present time a complete standard is about to be issued.)

Certain additional specifications required of plastics pipe might prove provocative to the reader:

- 1—Plastics pipe should terminate 3 ft from the building foundation.
- 2—Plastics service pipe should angle 90 deg from the long run of the service to the service riser.
- 3—If at all possible, the service lines should parallel the lot line at a distance from this line of 3 ft.

In conclusion, Arizona Public Service, at a time of short supply in the steel market, has no reluctance in substituting acceptable plastics materials for steel. It is further concluded that with this encroachment of these plastics materials into an area normally commanded by steel, steel will never completely recover the total market.

The operating man is still concerned with the exposure that exists for buried structures of all kinds of services and materials, and just how these plastics materials will compete with steel, lead vitreous and cement asbestos. After almost one year's operation on this unconventional gas system, Arizona Public Service Co. has had no detrimental experiences and is continuing the installation of plastics pipe. ■

Arizona's preliminary plastics pipe installation specifications are on the following pages.

FORM NO. 9162 3000 10-58 SWL

DETAILED ESTIMATE OF COST
Property Additions and Sundry Accounts

PE No. WA No.

ACCT NO.	ITEM	UNIT	UNIT COST (EST.)	QUANTITY EST. NO. OF UNITS	QUANTITY ACTUAL UNITS PER FOREMAN	QUANTITY ACTUAL UNITS PER BOOKS	QUANTITY ACTUAL UNITS BOOKS OVER EST	PROPERTY ADDITIONS COST ESTIMATED ITEM COST	PROPERTY ADDITIONS COST ESTIMATED ADDITIONS	PROPERTY ADDITIONS COST ACTUAL PER BOOKS	PROPERTY ADDITIONS COST ACTUAL BOOKS OVER EST
	4" C. Steel pipe	Ft.	.79	2240				1770			
	3" C. Steel pipe	Ft.	.72	7575				5088			
	2" C. Steel pipe	Ft.	.51	24730				12612			
	1-1/4" C. Steel pipe	Ft.	.34	48455				16474			
	6" C. Steel Pipe	Ft.	2.55	200				510			
	4" Weld & Wrap Job	Job						151			
	3" Weld & Wrap Job	Job						237			
	2" Weld & Wrap	Job						810			
	1-1/4" Weld & Wrap	Job						1200			
	6" Weld & Wrap	Job						450			
	3" Lube Valve	ea.	20.51	3				62			
	2" Lube Valve	ea.	12.00	1				12			
	3" Weld Flange	ea.	5.13	6				31			
	2" Weld Flange	ea.	3.26	2				7			
	2" R/W Stopcock	ea.	7.92	8				63			
	2" S/W Stopcock	ea.	4.60	12				55			
	1-1/4" R/W Stopcock	ea.	4.68	28				131			
	1-1/4" S/W Stopcock	ea.	2.86	40				115			
	R.R. Casing Mat.	lot						150			
	6" Valve Box	ea.	18.00	4				72			
	Cathodic Protect.	Job						240			
	Misc. Mat.	Job						100			
	M & S. Loading							1139			
	Labor	Job						33200			
	FR Loading							5000			
	Transportation							6450			
	Subsistence							11600			
								97669			

# Charges to Appropriate Blanket W. A. or Oper. Acct.	TOTAL	
	TOTAL (Excl. # Charged to Blanket W. A.'s)	
TOTAL COST CHARGEABLE TO THIS W. A.	Property additions plus Sundry Accounts, plus Removal Cost, minus Salvage Value.	$

Work Started ____ 19____ Work Completed ____ 19____ Placed in Service ____ 19____

By ____ Foreman Date ____ 19____ Plant Acc'tg. Dept. Cost Analysis - By ____ Date ____ 19____

Fig. 3. Estimated cost to construct "estimated" system using all coated steel pipe.

Preliminary plastics pipe installation specifications

The following are the general specifications for the installation of plastics pipe in Gila Bend. Included in these specifications are sketches showing the method of running plastics pipe from a steel main, use of Mueller's plastics tee, terminating a plastics main which could possibly be extended in the future, and installation of valves in plastics mains. These specifications are tentative provisions not covered in the general specifications for Gila Bend.

Boring:

Boring shall be handled in accordance with the "Gas Distribution Standards." A torpedo must be used in all cases to push rocks out of the way and thus protect the pipe from being damaged.

Handling:

Plastics pipe is light in weight and should be handled by hand in all cases where it is practical. Should it become necessary to lift or move plastics pipe with a hoist, care must be taken to cushion the pipe against damage. After the pipe is handled by a hoist, inspect thoroughly for possible damage.

Solvent welded joints:

All joints and fittings will be cement welded in accordance with the "General Installation Instructions for Cementing Plastics Pipe and Fittings," given in Table I.

Plastics tees:

Plastics tees shall be installed according to general instructions for installation of plastics tees (see Table II).

Service trench:

The minimum depth of service trench shall be 24 in.

Testing:

All couplings and fittings are to be soap tested until the foreman determines that such tests are unnecessary. These tests to be carried out with a minimum of 60 psig pressure. Plastics tees shall be soap tested throughout construction.

Valves:

Valves will be installed according to Fig. 4S of this specification.

Dresser couplings:

Whenever Dresser couplings are installed, a meter stiffener must be used in all cases to reinforce the plastics pipe; this metal stiffener will fit the inside diameter of the pipe. Care must be taken not to over-tighten the Dresser coupling to such an extent that the plastics pipe will be damaged.

Copper wire:

No. 18 or No. 20 gage copper wire with polyethylene coating shall be strung along all plastics pipe to be used in conjunction with pipe locator after installation of plastics pipe is completed. This wire will be attached to the pipe at approximately 40-ft intervals with friction tape. All exposed copper wire shall be coated with Roskote to prevent deterioration of the copper wire. All copper wire connections must be solid connections by the use of clips or by welding. Copper wire will be installed along service pipe and brought above ground on the service riser.

TABLE I. General Installation Instructions for Cementing Plastics Pipe and Fittings

Cement Welded Pipe and Fittings

The plastics pipe and fittings to be jointed should be exposed to the same temperature conditions for a reasonable length of time before assembly.

Use a fine tooth hack-saw, cut pipe to desired length, removing burrs with a file.

Wipe outer surface of pipe and inner surface of fittings with a clean cloth to remove all foreign substances and moisture before the application of the cement solution.

Using a *natural bristle* brush, having a width of approximately three-quarters the depth of the socket, apply plastic cement to the fitting socket and plastic cement to the pipe. The cement solution should be applied freely with a light wiping action to spread uniformly over the surfaces. Don't rub the surface of the pipe or fitting socket with the brush any more than is necessary.

Immediately after the cement has been applied to the surfaces to be joined, insert the pipe into the fitting in a straight line. DO NOT TWIST.

Immediately after joining is completed, wipe off excess solution at end of fitting. Excess cement should not be allowed to dry on the pipe.

The joined members should be allowed to cure for five minutes before they are handled. (In cold or damp weather, this interval should be increased to allow for the slower evaporation of the solvent.) Another fitting or pipe section can be added to the opposite end within two or three minutes if care is exercised in handling so that undue strain is not placed on the previous assembly.

In cases where a plastics connection is made with the union under stress due to misalignment or other factors, the plastics joint must be held rigid after insertion for the cure period. Plastics pipe should be laid on level, undisturbed or well compacted earth. In back-filling a trench, or ditch, first cover pipe carefully with soft earth, avoiding the dropping of rocks or clods on the pipe.

For long runs, plastics pipe should be snaked into the ditch during installation to allow for expansion or contraction due to temperature changes.

To minimize accidental damage, plastics pipe should not be left exposed in an open ditch any longer than is absolutely necessary.

If cement thickens, use thinner to cut consistency.

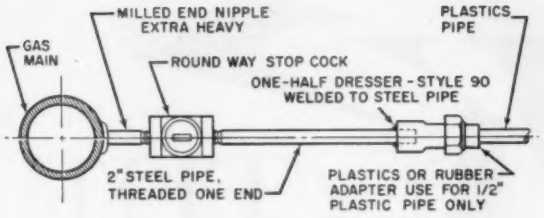


Fig. 1S. Plastics Pipe Connections to Steel Mains

This assembly is similar to the standard drawing 8G-807, Fig. 4 of the gas distribution standards, with an extended nipple between the stopcock and coupling. This will be the same as the standard method for tapping steel mains. The purpose of the extended nipple is to place the coupling-plastics pipe connection outside of bellhole to protect plastics service or main during backfilling operations. Extended nipple and coupling can be prefabricated in shop.

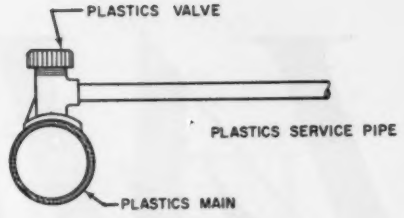


Fig. 2S. Tapping Plastics Mains for Plastics Services

The plastics valve tee will be used to tap plastics mains. The tee has a built-in cutter for making the tap. No adapter will be necessary for connecting plastics service pipe to tee. Since the pipe-tee connection will be located inside the bellhole, extreme caution should be exercised during backfilling operation.

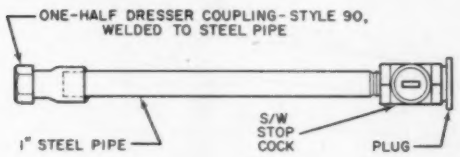


Fig. 3S. Ending Plastics Main for Future Extension

The purpose of this assembly is to end installed plastics mains that may be extended at a future date. Coupling is fastened to end of the plastics main and the line is purged through the S/W stopcock. The stopcock is then plugged with a metal plug.

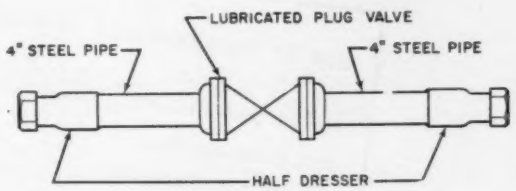


Fig. 4S. Connecting Plastics Pipe to Metal Lube Valves

In order to install metal valves in plastics mains, weld half couplings (Style 90) on the end of each stub extending from the valve flanges.

TABLE II. General Instructions for Installation of Plastics Tees

1. Clean plastics main, service pipe, and inlet and outlet bond surfaces of plastics tee thoroughly with clean cloth.
2. Place bonding bands around plastics main in a position which will be ready to tighten as soon as tee is placed in position.
3. Apply plastics pipe solvent to main and tee inlet bonding surface. Mount tee on main, hold firmly in place by hand while bands are placed in position and tightened severely. Bands will be left in place on each tee. (Note: Do not allow solvent to contact inside threads of tee.)
4. Apply solvent to outlet surface of tee to service main. Insert service pipe into tee as far as possible. Allow to set for 25 min. before testing. Test from meter end of service line with pressure gauge or soapsuds.
5. Attach plastics tee drilling wrench to brace and engage splines in plug. Rotate clockwise, advancing combined plug and cutter until cut is completed. (Note: Be sure that drilling wrench is firmly held in splines inside of tee to prevent stripping the splines. Do not, at any time, attempt to tap the main with any equipment other than prescribed brace and drilling wrench.)
6. Reverse ratchet and turn brace counter-clockwise to retract combined plug and cutter until upper shoulder comes in contact with "O" ring at top of tee. (Note: Pressure is now held by contact of "O" ring with plug.)
7. Screw completion cap onto tee, *hand tight.*
8. To stop off service line, remove completion cap, advance combined plug and cutter with drilling wrench until shoulder of plug contacts seat at bottom of tee.

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PLASTICS PIPE

What is expected of good pipe?

Testing butyrate pipe

By ROY O. HILL JR.
Technical Information Section, Plastics Division
Eastman Chemical Products Inc., Kingsport, Tenn.

A GOOD pipe begins in a physical testing laboratory. In the case of pipe extruded of Tenite Butyrate plastic, it began in the physical testing laboratory of the Tennessee Eastman Co., division of Eastman Kodak Company, in Kingsport, Tenn.

A material suitable for the manufacture of good pipe must be strong, it must be tough, and it must be resistant to any material to be conveyed through it. Back in the early 1940's, Tenite Butyrate—designated at that time as Tenite II—appeared to be such a material. It had high tensile strength, very good Izod impact strength, and very good resistance to water and most aqueous solutions, as well as to aliphatic hydrocarbons, including gasoline and sour crude oil.

Due to the complex nature of forces acting upon the inside of a pipe, however, as well as to the vagaries of plastic properties when the plastics is processed by different methods, the normal physical testing laboratory could not provide all the answers insofar as the use of plastics pipe was concerned. In the middle 1940's, therefore, the pipe testing laboratory was instituted at Tennessee Eastman.

The pipe testing program over the years has narrowed down the types of meaningful tests on plastics pipe to: (1) short-time burst, (2) creep tests, (3) impact strength, (4) a few minor tests for specific applications. Tests involving the effects of various chemicals are not run on pipe, as these are strictly tests of the material. Such tests are run on compression-molded samples as a normal part of plastics testing.

It must be emphasized that the measurement of properties of plastics pipe is an evaluation of two factors—the material used for making the pipe and the techniques of extrusion used. The latter factor is of extreme importance. All pipe tested in our pipe laboratories for reporting purposes has been extruded here and is known to have quality to insure that those limitations found are material limitations.

• Short time burst strength

Short time burst strength is a measure of a material's ability to withstand momentary overloads such as those developed when liquid flow through a pipe is stopped suddenly. It may also be used as a measure for adequacy of extrusion techniques. Badly extruded pipe will usually tend to be brittle. This is shown in pipe by a glassy-type break with little expansion of the pipe prior to rupture. Properly extruded pipe will expand considerably before rupture occurs, and the break will be ductile in nature.

Short time burst usually occurs at about four or five times the working pressure of a pipe, and is used as a starting point for estimating the pressures which

Fig. 1. Programmed controller used to burst butyrate pipe. "Set" arm of recorder-controller rides edge of cam, which turns at a speed to produce a pressure rise of 10 psig per second. Since system being controlled is small, "recording" arm follows "set" arm with no visible time delay.

will be employed for testing the long-time creep.

For testing short-time bursting pressures of pipe, a recorder-controller was equipped with a special high-speed drive mechanism. A cam was cut as shown in *Fig. 1.* Only one projection on the cam is used for a single burst test. The angle of the cam and speed of the clock drive mechanism are such that pressure in the pipe being tested is increased at a constant rate of 10 psig per second. A record of the pressure is kept by another recorder.

Prior to testing, pipe to be tested is conditioned at the proper temperature by complete immersion in water. One-inch pipe is conditioned for at least one hour. Larger pipe is conditioned for at least two hours. The pipe is burst with hydrostatic pressure, under water, in the cabinet shown at left-center in *Fig. 2.* These conditions eliminate flying pieces of pipe in the laboratory. The capacity of the testing pump is 3500 psig.

Pipe in SWP sizes is usually flanged and installed in the bursting cabinet with aluminum flanges. IPS sizes are ordinarily connected with Telsco fittings. Solvent-welded connections are sometimes used for both pipe sizes.

The result of a burst test is reported as hoop stress, rather than as bursting pressure. Bursting pressure would be applicable only to one size of pipe. Hoop stress may be applied to any pipe made from the material being tested. The hoop stress is calculated according to Barlow's formula:

$$S = \frac{P \times O.D.}{2T}$$

S = Hoop stress, psi
P = Internal pressure, psi
O.D. = Outside diameter, in.
T = Wall thickness, in.

It is obvious from the formula that this is the force acting upon a hoop of plastics which is a section of the pipe wall, tending to elongate and rupture this hoop. And, it might be expected that this value is the same as the ultimate tensile strength of the plastic. These two values are not the same for two reasons. First, all stress in the pipe wall is not in the hoop direction—there is half as much stress in the longitudinal direction, down the pipe, as there is on the hoop. Second, tensile strength of the material is run at a constant rate of strain increase; pipe burst is run at a constant rate of stress increase.

The ultimate hoop stress (hoop stress at burst) of cellulose acetate butyrate pipe varies approximately linearly with temperature. Typical values for the results of burst tests are shown in *Fig. 3.* Suggested hoop stress limits for long-time service are also shown, for comparison.

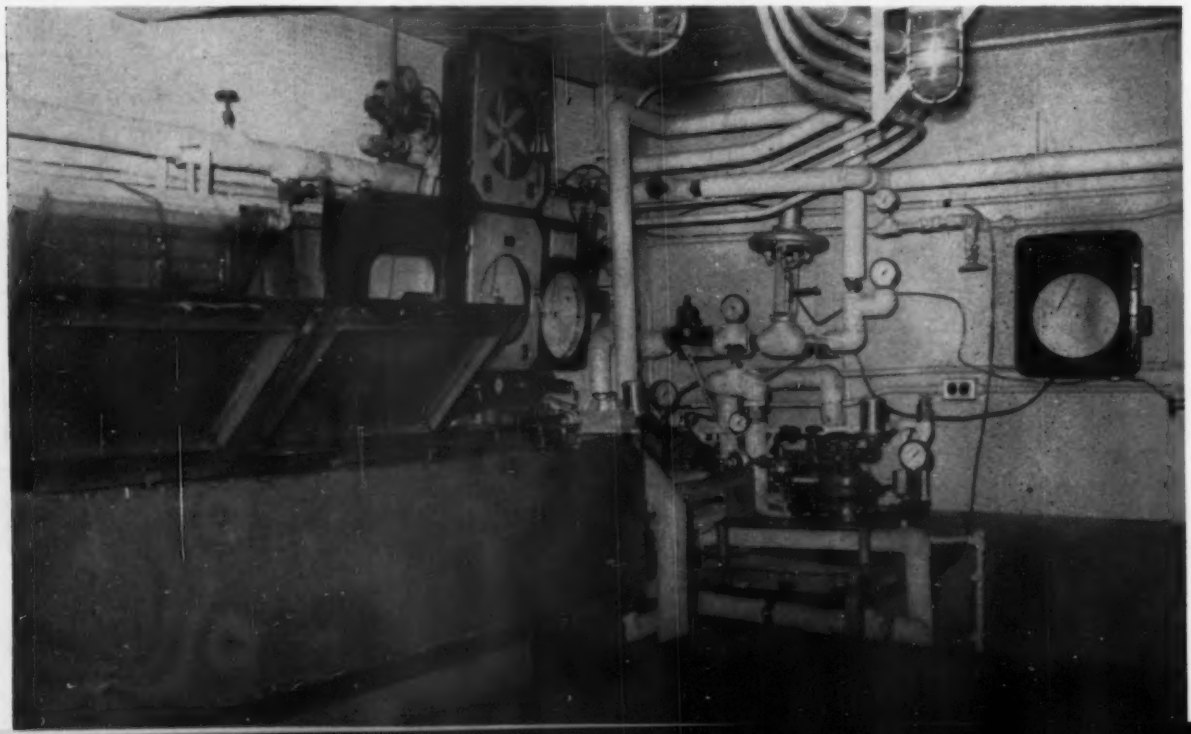
• Creep test

The test used to determine allowable working pressure of pipe is the creep test.

Cellulose acetate butyrate plastics, in common with many materials, undergo a phenomenon known as cold flow, or creep. This process is not limited to materials commonly called thermoplastics. It also occurs with such materials as steel, glass and concrete; but the degree is very small in these materials, and it is usually not noticed.

Tenite Butyrate is a viscoelastic material, which means its behavior is a mixture of the viscous and the elastic. When a force smaller than the yield

Fig. 2. Pipe bursting section of pipe lab. Controller shown in Fig. 1 is in upper center of picture. Immediately below it is recorder which records pressure in pipe being burst, so that yield and burst pressures may be read from a graph. The other recorders shown keep records of various temperatures in pipe lab. Insulated, covered box used to contain pipe specimens during burst test is at left. Lids of this box contain windows covered with butyrate sheeting; so that behavior of pipe during burst may be observed. Pressure pumps and regulating systems are in background.



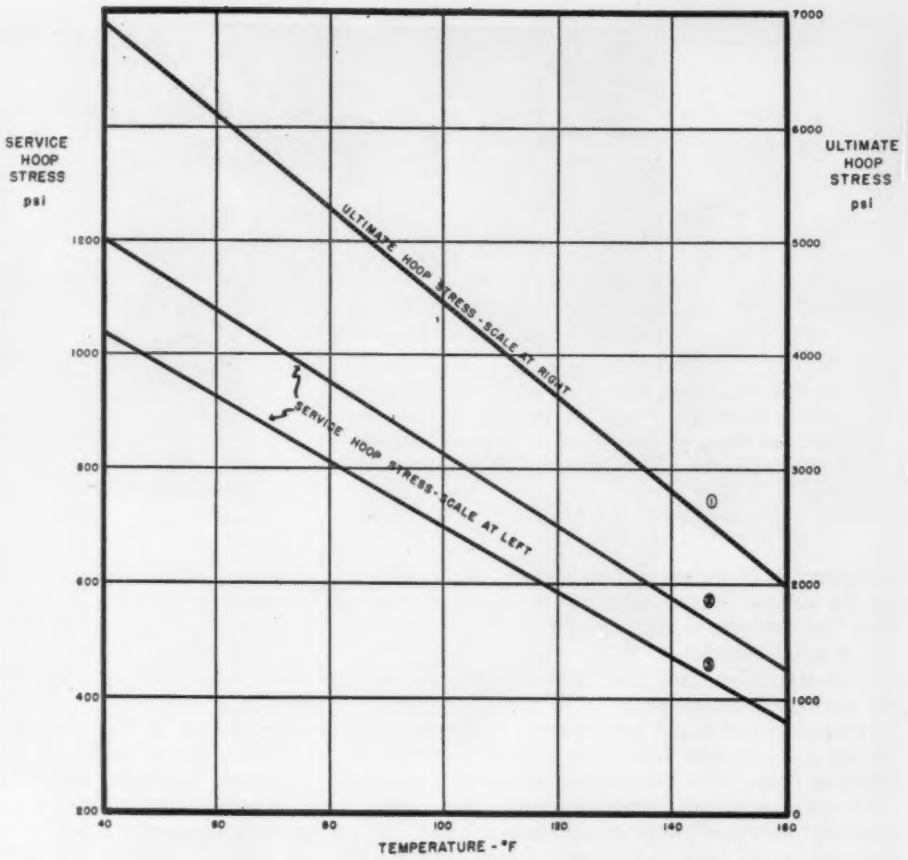


Fig. 3. This shows the variation of hoop stress at burst for butyrate pipe with temperature, and compares these values with service hoop stress for same pipe. For example, at 100 deg F, approximately 4500 psi hoop stress would be required to rupture butyrate pipe, but creep tests show that excessive creep will occur if pipe is used at hoop stress levels much in excess of about 825 psi. AGA recommends a conservative 700 psi.

LEGEND

(1) Average hoop stress of butyrate pipe at burst.
(2) Hoop stress shown by creep tests to be suitable for long-time use of butyrate pipe.
(3) Hoop stress advocated for butyrate pipe by AGA, includes additional 15 per cent safety factor.

strength is applied to this plastics, an immediate elastic deformation occurs. This is shown in *Fig. 4*, which plots elongation of a plastics specimen against time, under the influence of a stress applied at time t_0. The instantaneous deformation shown is completely and immediately recoverable upon removal of the stress. All the elastic deformation is not immediate, however. Time t_0 to time t_1 exhibits another type of deformation, which is viscoelastic in nature. This is known as delayed elastic deformation or primary creep.

The rate of this deformation is exponential. It approaches some ultimate elastic strain limit asymptotically. A plot of this deformation against the logarithm of time should give a straight line. Actually, this deformation never reaches the ultimate elastic limit toward which it is progressing in a finite time. In infinite time, it would. If, at time t_1, stress on the plastics is relieved, the instantaneous elastic

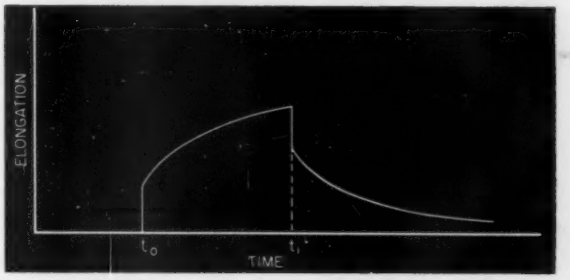


Fig. 4. Typical elongation vs. time curve for butyrate under conditions which do not cause non-recoverable creep. A stress applied at time t_0 causes an immediate elastic deformation followed by a delayed elastic deformation. Relief of the stress at time t_1 is followed by an immediate recovery of the elastic portion of the deformation, then a delayed recovery of the delayed deformation. (See text for further details.)

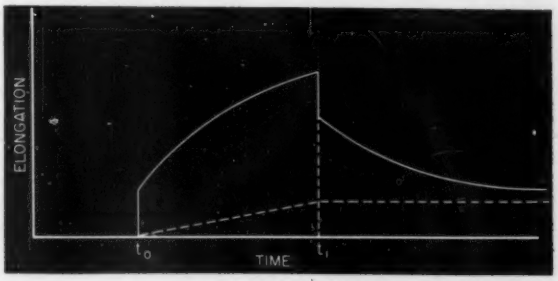


Fig. 5. Typical elongation vs. time curve for butyrate under conditions which cause non-recoverable creep. A stress applied at time t_0 causes an immediate elastic deformation followed by a delayed elastic deformation and a slow viscous deformation. Relief of the stress at time t_1 allows an immediate recovery of the elastic portion of the deformation, followed by a delayed recovery of the delayed deformation, but no recovery of the viscous deformation. (Further details in text.)

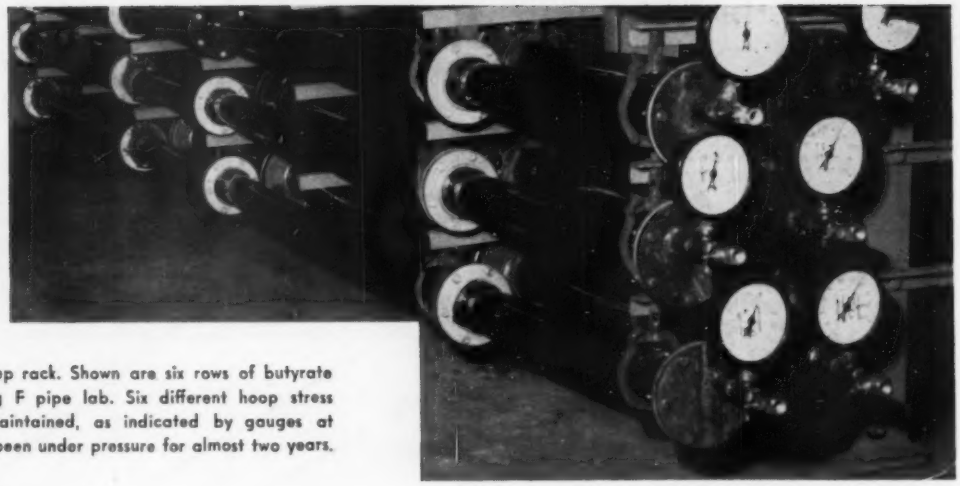


Fig. 6. Butyrate creep rack. Shown are six rows of butyrate pipe in the 73 deg F pipe lab. Six different hoop stress levels are being maintained, as indicated by gauges at right. This pipe has been under pressure for almost two years.

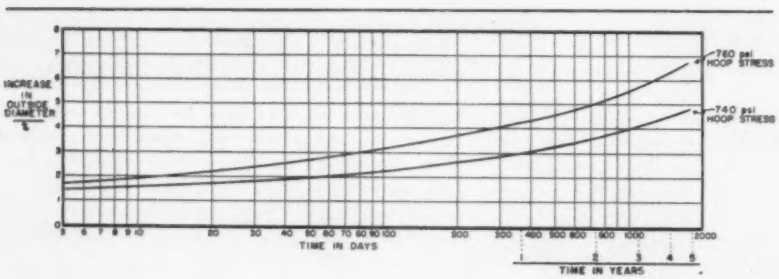
deformation is recovered immediately, while recovery of the delayed elastic deformation begins at such a rate that in infinite time the plastic would return to its original length.

The discussion thus far has neglected true creep, or secondary creep, which is a purely viscous flow phenomenon and is not recoverable. Under conditions which cause it, and under constant stress, secondary creep is linear with time and continues at a constant rate for the entire length of time that stress is applied. However, since most plastics usage occurs under constant load, and since the cross-section of a plastics specimen becomes smaller as it deforms, stress on the plastics usually increases with time, resulting in an upward curvature of the time-deformation curve.

Fig. 5 shows deformation of a plastics specimen which is sufficiently heavily loaded to cause secondary creep. Again, as in *Fig. 4*, the stress is applied at t_0 and maintained until t_1. The deformation of the plastics is shown by the solid line. However, the "base length" of the specimen, which will be defined as the length of the plastics specimen neglecting elastic extension, is slowly increasing simultaneously, as shown by the horizontal broken line in *Fig. 5*. Therefore, if, at time t_1, stress is relieved, the delayed elastic recovery would not approach the original length of the plastics, but would begin an asymptotic approach to the extended length of the plastics which would be the original length plus the length of the secondary creep.

It should be obvious from the above discussion that the useful life of a plastics pipe would be severely limited if an appreciable amount of viscous deforma-

Text continues on page 100



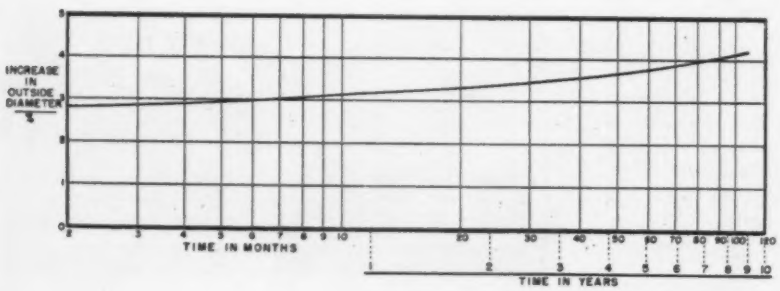
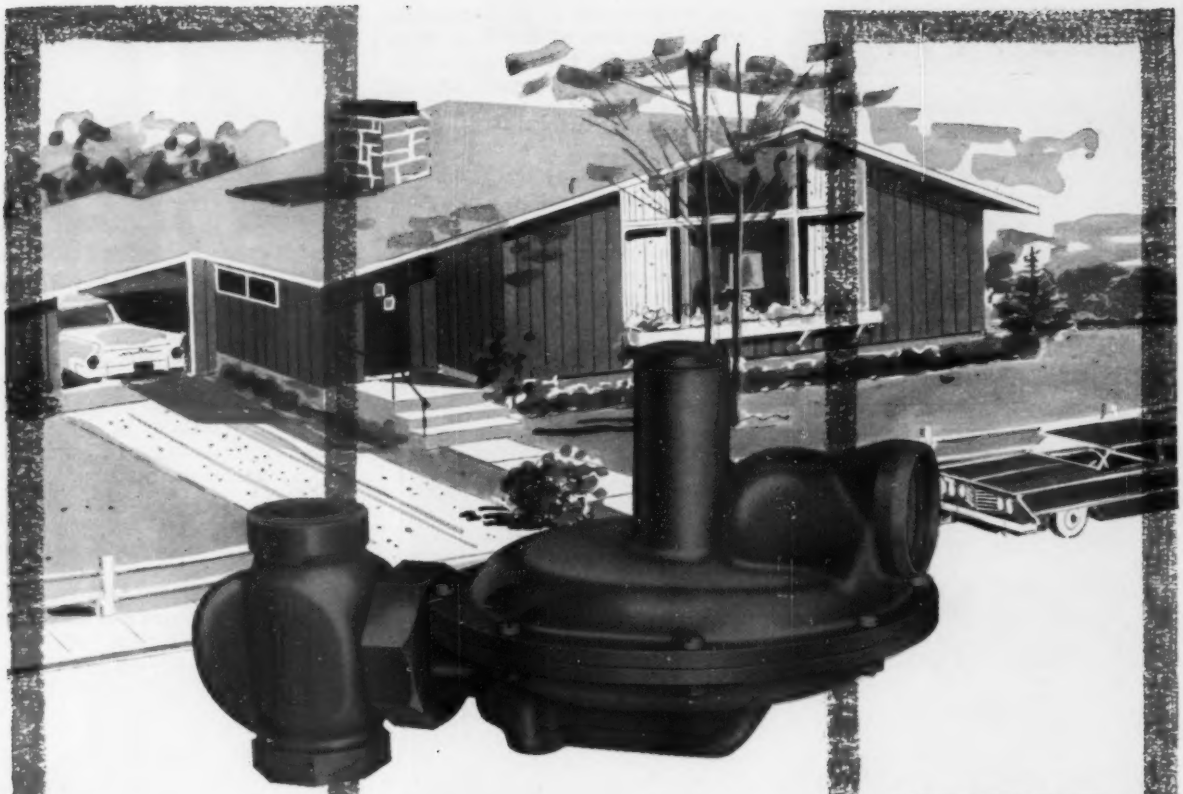


FIG. 7. CREEP OF BUTYRATE PIPE

Fig. 7A (top left) shows increase in diameter of butyrate pipe pressurized with water at 120 deg. F under hoop stress levels 40 and 60 psi higher than the suggested 700 for this temperature. Secondary creep, or nonrecoverable deformation, is shown by upward curvature of line. Creep of this magnitude is considered excessive, although it might be completely satisfactory for several years.

Fig. 7B (bottom left) shows creep experienced in an actual outdoor water line which has been in use for 116 months—nine and two-thirds years. Service received from this line has been quite satisfactory. (NOTE: Hoop stress, 720-1080 psi, variable; air temperature, 20-100 deg F, variable; water temperature, 35-95 deg F, variable.)



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GAS·PEOPLE

E. HOWARD FISHER has been elected vice president of Pacific Gas & Electric Co., San Francisco. He is in charge of the company's gas operations, succeeding the late PHILIP E. BECKMAN. Since 1954, Fisher has been general superintendent of pipeline operations.

ALVIN M. HUTCHISON is the newly named manager of transmission for Ohio Fuel Gas Co., Columbus. He succeeds J. H. LANG, who retired the first of the year. Hutchison, with the Columbia Gas System for 32 years, has been serving as assistant manager of transmission.

Several changes have been made in Michigan Consolidated Gas Co.'s sales department. WILLIAM J. MARION is returning to Detroit from Mt. Pleasant to become manager of industrial and commercial sales. He will be in charge of the company's industrial, commercial and air conditioning divisions. ROBERT G. GRICE succeeds Marion as sales manager of Michigan's northern districts, headquartered in Mt. Pleasant. WILLIAM E. GREEN is sales superintendent of Detroit district's commercial division.

Howard Fisher
PG&E

A. M. Hutchison
Ohio Fuel

ROBERT E. MAGUIRE has been named vice president and manager of Lawrence (Mass.) Gas Co. He succeeds GEORGE W. CULVER, who has retired. Maguire has served as general superintendent of Lawrence for the past year. He is succeeded in that post by ARMANDO O. GUARINO.

E. M. WILLIAMS has been promoted to sales manager of Continental Equipment Co., butterfly valve division of Fisher Governor Co. He has been a sales engineer with Continental since 1954.

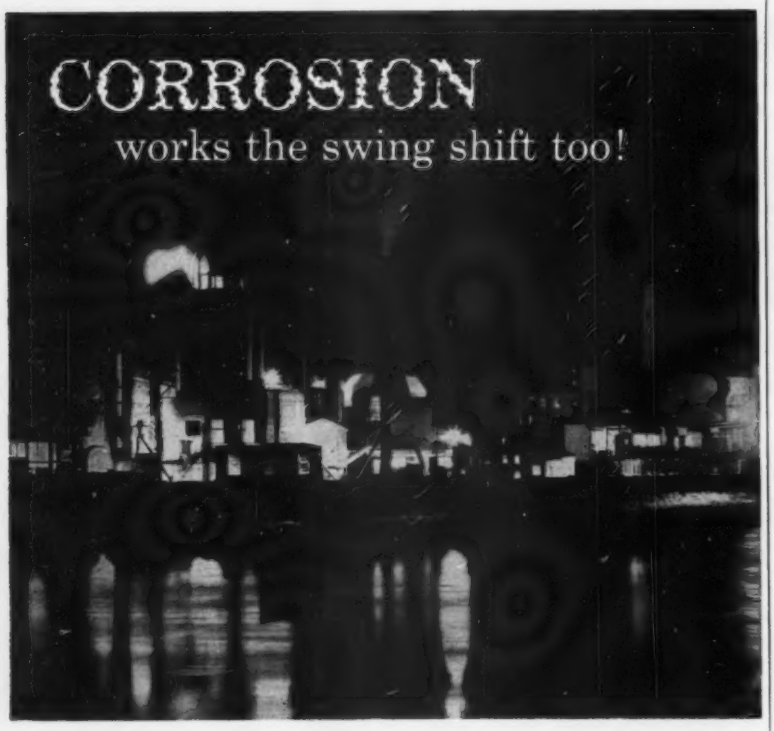
H. W. SLACK and M. C. WESTRATE are directors of Commonwealth Services Inc., New York. Both men are officers of Commonwealth Associates Inc., Jackson, Mich., engineering affiliate of Commonwealth Services.

ROBERT D. CRANE has been named director of purchases and traffic of Dresser Industries Inc., Dallas. He succeeds ROBERT C. KELLEY, who is retiring.

W. H. GILL, assistant to the president of Washington (D. C.) Gas Light Co., has retired. He was succeeded by ROBERT T. KEITH.

W. J. Marion
Michigan

Robert Grice
Michigan



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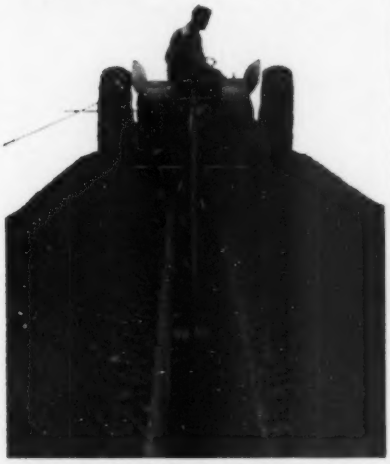

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H. E. ROSSELL JR. has been promoted to general sales manager and R. J. BERKSHIRE to general marketing manager of the air conditioning division of American-Standard. W. H. BAKER JR., former vice president, marketing, American Standard air conditioning, has joined the company's plumbing and heating division.

PHILIP W. BARCHARD has been appointed general manager of B. C. Electric's gas division. He succeeds E. H. ROHRER, who is retiring. Barchard has been with BCE since 1946, and has served as assistant general manager of the gas division since 1957.

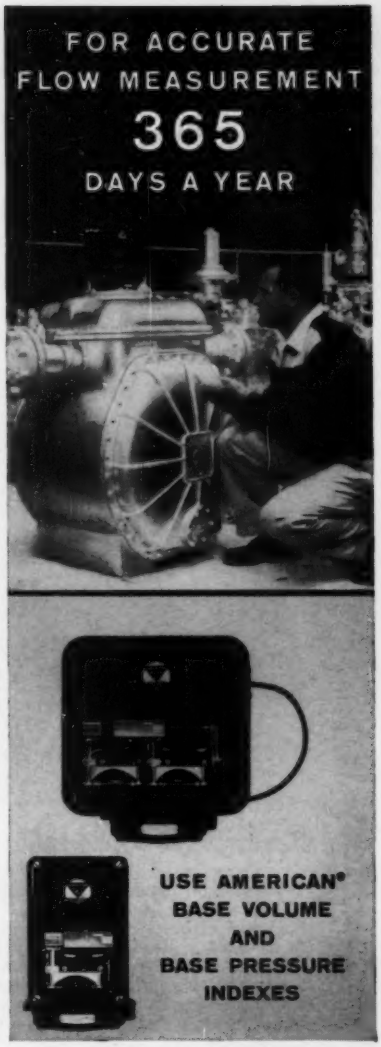
EDWARD C. HEMES has been elected vice president of Reeves Brothers Inc., New York. Hemes formerly was superintendent of measurement at Milwaukee Gas Light Co. He became executive vice president of Vulcan Rubber Products Inc., and in 1953 joined Reeves, when Vulcan was acquired by Reeves. JAMES R. COOPER has been named general sales manager of Vulcan. He is succeeded as product manager at Reeves by WALTER A. MCEVILLY.

Stone & Webster Engineering Corp., New York, has elected T. CORTLANDT WILLIAMS as chairman of the board. FRED W. ARGUE, executive vice president, succeeds Williams as president. Other changes include the election of ALFRED L. HARTRIDGE as executive vice president and Dr. ARTHUR J. GOOD as vice president and treasurer.

PATRICK B. O'ROURKE has been elected assistant vice president of Northwest Natural Gas Co., Portland, Ore. O'Rourke, who joined the company in 1947 as personnel and job training engineer, will continue as general operating manager, a post he has held for eight years.

P. W. Barchard
B. C. Electric

Edward Hemes
Reeves



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In a reorganization of its sales department, Barber-Greene Co., Aurora, Ill., has appointed two regional sales managers and a field sales manager. New regional sales manager for the western division is RALPH DANO; regional sales manager for the eastern division is KENT SHELL. The eastern and western regions are divided, roughly, by the Mississippi river. TOM BENBOW was named field sales manager. All three men will headquarter in Aurora.

JOHN R. FEEHAN has been appointed new business supervisor of Southern Counties Gas Co.'s San Gabriel Valley division sales staff. VINCENT E. SINGLETON was named staff representative, air conditioning. Feehan has been commercial sales representative on the Los Angeles sales staff while Singleton was acting new business supervisor in San Gabriel.

BOHDAN G. PASSTY has assumed the post of development engineer in charge of the Humphrey heating division of Arkla Air Conditioning Corp., Evansville, Ind.

EARL G. DAVIDSON has been promoted to national service training supervisor of the Norge Division of Borg-Warner Corp., Chicago. He will direct the company's national appliance service training center at Muskegon, Mich.

White-Rodgers Co., St. Louis, has appointed HAROLD E. TETTAMBEL as Des Moines district manager and F. J. MANEY as New York district manager.

RICHARD S. MURRAY is administrative assistant to Charles E. Baltzel, western division manager of New York State Electric & Gas Corp. Murray has been the company's representative at Silver Creek. He is succeeded in that post by TUNIS E. BARBITE.

ALFRED H. DOUD has been appointed associate director of public relations for Rochester (N. Y.) Gas & Electric Corp. Doud formerly was assistant manager of the department.

CARL G. HESTER has been named new business representative by Piedmont Natural Gas Co., Charlotte, N. C. He will work in the Winston-Salem, High Point, and Salisbury districts.

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Low, Medium and High Pressure

METER SETTINGS
Flat Head • With or Less Check Lock Wing

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Three-Way • Graduated Dial

APPLIANCES and EQUIPMENT
Lever Handle • Square Head
Flat Head
A.G.A. Listed Control Valves

GENERAL PRODUCTS DIVISION
HAYS MFG. CO.
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LOUIS B. HULCY has been named general superintendent of Lone Star Gas Co.'s general division of distribution. W. H. OCHTERBECK succeeds Hulcy as chief engineer and J. P. SHULTZ becomes distribution engineer. Hulcy, Ochterbeck and Shultz will headquarter in Dallas. R. E. READING has been named manager of the rate section of the comptroller's department.

L. E. SAVORY has been named assistant director of research for United Gas Corp., Shreveport. Since 1953, Savory has been project supervisor at the company's research laboratory.

JAMES M. STUART, president and general manager of the Dayton (Ohio) Power & Light Co., was elected director of the Winters National Bank and Trust Co. of Dayton.

THOMAS A. RAMEY has joined Hamilton Manufacturing Co., Two Rivers, Wis. as advertising manager. . . . ROBERT A. PIERCE and F. GORDON LENZI are general manager and sales manager, respectively, of the Lennox-Syracuse (N. Y.) division of Lennox Industries Inc. . . . WALTHER H. FELDMANN, president and a director of the Worthington Corp., has been named to the board of Babcock & Wilcox Co. . . . GEORGE R. CORCORAN has been named manager of advertising for the American Car & Foundry Division, ACF Industries Inc.

WALTON A. LEAN, vice president and technical director of Wilcolator Co., Elizabeth, N. J., has retired. Lean received GAMA's Meritorious Service Award for serving as chairman of the controls division, 1940-41. . . . LEE A. BRAND, vice president of Empire Stove Co., is a member of the board of directors of Morley Manufacturing Co. . . . CLARENCE DUNLOP, vice president-manufacturing facilities planning, Burroughs Corp., has retired after 40 years of service.

Deaths

HAROLD L. NICHOL, former system-wide transportation superintendent for New York State Electric & Gas Corp., died recently. He was 72. Mr. Nichol retired in 1952.

FRANK C. GORDON, assistant treasurer of Consolidated Edison Co. of New York, died recently.

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AL-175
ALUMINUMCASE METERS

LIGHT WEIGHT AND RUGGED

Precision-built AL-175 Aluminumcase meters are unequalled for dependable, economical domestic service. American's quality features assure maximum accuracy from pilot load to full rated capacity. And these light weight A.G.A. Class 175 meters provide important economies in shipping, handling and setting costs.

- One-piece, die-cast aluminum alloy body.
- 3-Convolution, molded Duramic diaphragms.
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- Vented, plastic index box.
- Rated capacity 175 cfh of 0.60 sp. gr. gas at ½-inch w. c. differential. Working pressure 5 psi.

Ask your American representative for Bulletin 305.

AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)
General Offices: Philadelphia 16, Pa.
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Testing butyrate pipe

Continued from page 94

tion, or secondary creep, were allowed to occur in use. The data which have been collected over the past several years give a strong indication that there is a threshold stress below which secondary creep does not occur in butyrate pipe, or below which secondary creep is so slow as to be negligible. The function of the creep test is to determine this threshold stress level. Since delayed elastic deformation, or primary creep, requires an infinite time to reach completion, very long times are necessary to determine whether the creep which occurs is primary or secondary. The creep test, therefore, will be carried on into the indefinite future. The more data that become available, the better the extrapolation which can be made into time.

Fig. 6 shows the creep test rack holding butyrate pipe. All connections are by compression fittings. Pipes are filled with water, then pressurized with nitrogen or compressed air. When the test was begun, explosion protection was provided by inserting a restriction in the compressed gas line to prevent wholesale loss of gas, or gas displacement of the water in pipes under pressure, in the event of a failure. This restriction has since been removed, having been found to be unnecessary. Failures have been very rare, and those pipes which have failed have always given advance notice by expanding 20 or 25 per cent before rupture.

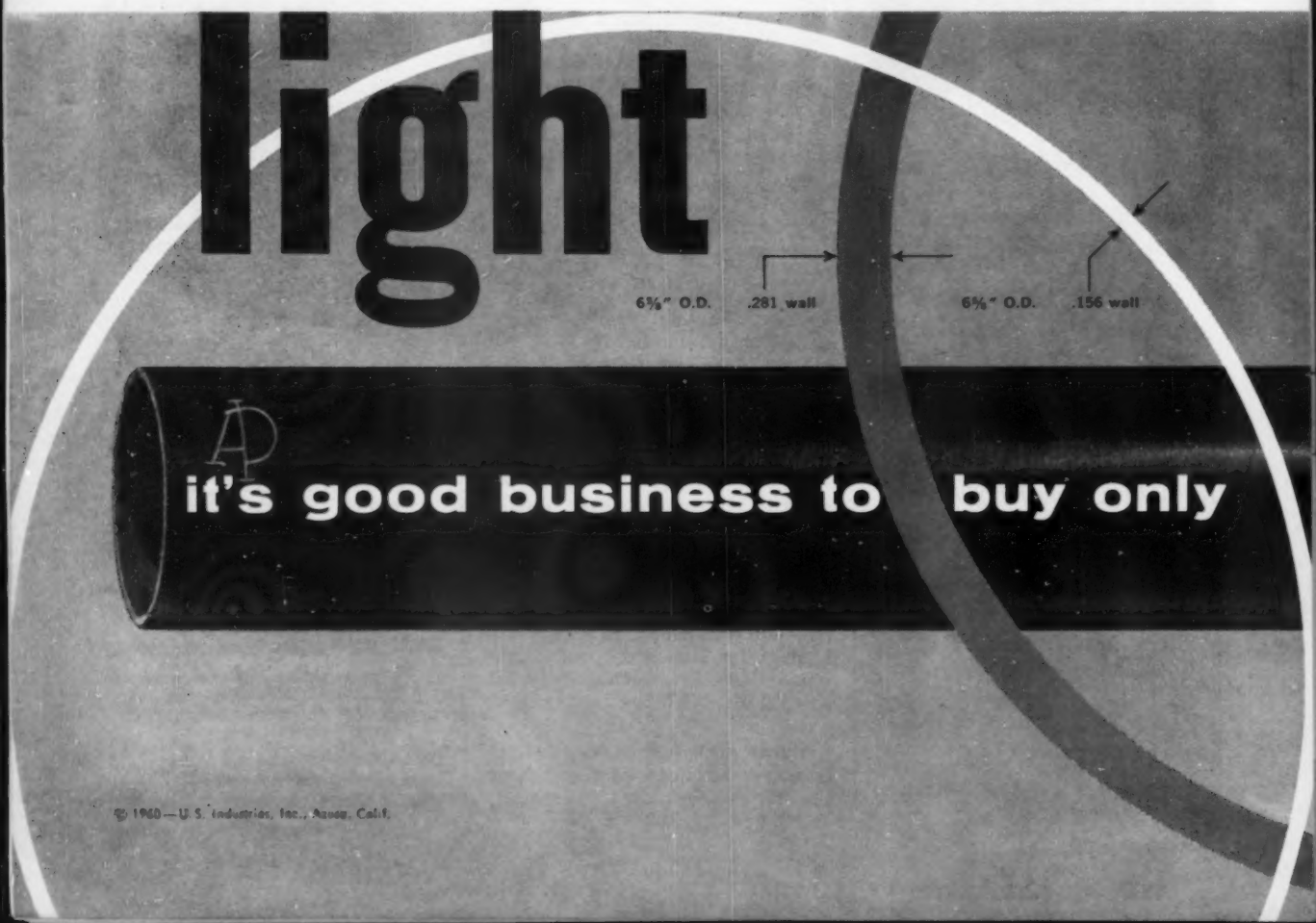
The pipes shown in the test rack have been under pressure for about two years. The pipe testing laboratory is maintained at 73 deg F and 50 per cent relative humidity. A rack similar to the one shown is located in another room which is kept at 120 deg F. The humidity in this room is high, but is not controlled. These have been under test for over five years. Test installations around the plant have been in service for nearly ten years.

Measurements of pipe diameter are made with a special tape which reads diameter directly. All records are kept in terms of outside diameter, since hoop stress calculations are made using this figure.

Fig. 7A shows two curves obtained on pipe in the 120-deg F test. These show the large effects resulting from small stress differences when the stress is near the borderline of the useful long-time stress. The suggested maximum hoop stress for use of butyrate pipe at 120 deg F is 700 psi.

Fig. 7B shows deformation which has been obtained in 116 months of service in an actual installation. The conditions of stress and temperature are shown in the figure.

These figures show the deformation plotted against the logarithm of time. As previously explained, this type of plot results in a straight line as a result of delayed elastic deformation; but it gives an upward-



turning plot as a result of viscous deformation, or secondary creep, which is linear with time.

- **Impact test**

The first known impact test for butyrate pipe was reported by the Southern California Gas Co. in *GAS*, October 1946. Their test at that time used several different shapes of striking heads, which were attached as needed to a hinged arm and allowed to fall from various angles onto a pipe section which was held in a "V"-block. They later suggested a modified test in which the weights were allowed to fall freely through a pipe positioned vertically above the test specimen. Smith and Stone Ltd., of Toronto, Ontario, reported (*GAS* March 1956) use of a similar test. The striking head was a piece of 0.750-in. steel rod which was allowed to strike the pipe specimen horizontally, at right angles to the longitudinal direction of the pipe.

The impact test apparatus at Tennessee Eastman consists of an 8.000-ft length of 2.000-in. IPS butyrate pipe, which has an ID of 2.067 in. The striking head is a 0.500-in. diam. stainless steel rod about 1.500 in. long, threaded on one end and machined to a hemisphere of 0.250-in. radius on the other. Four cylindrical weights, stainless steel, 2.000 in. in diameter, weighing 2, 1, 1, and 1 lb are available. Each weight is drilled and tapped in one end and bears a threaded projection on the other. The striking head may be screwed into any of the weights and weights may be

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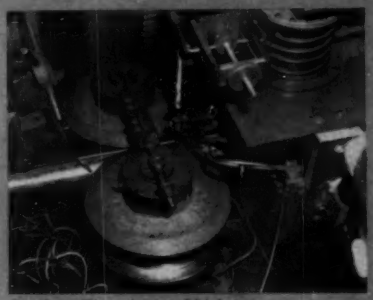
It's good business to buy only the steel necessary to do the job. In many cases you needn't buy heavy wall pipe, when Southern's LITE-WALL pipe—available from factory stock—will meet your requirements and afford an ample safety factor.



Southern Pipe pioneered high frequency resistance welding in pipe production.

Southern Pipe offers oil and gas pipe buyers LITE-WALL pipe to cut cost. They also produce line pipe according to API specifications. Sizes range from 3" to 14". Interior and exterior coatings are also available.

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SP-6-60

coupled together in any desired combination. The full 5 lb is normally used.

In use, the butyrate guide pipe is positioned vertically above the test specimen. The pipe is graduated at 6-in. intervals and two holes are drilled through its wall, diametrically opposite each other, at each graduation mark. The weights slide inside this vertical pipe, being raised by a rope running upward through the butyrate pipe and across a pulley above the pipe. They may be held at any desired level by insertion of a steel rod through any pair of holes. Removal of the steel rod allows weights and striking head to fall freely through the pipe and strike the pipe specimen. The use of a clear butyrate pipe as a guide allows full visibility of the weights and striking head at all times and produces minimum friction.

The pipe to be tested is cut into 6-in. lengths and conditioned for 48 hours prior to testing in 73-deg F water. Just prior to testing, the pipe is conditioned for 30 minutes in a bath of crushed ice slurry in water. At the end of the conditioning period, the weight and striker are raised to the desired height. A specimen of pipe is removed from the ice bath, placed in the steel channel shown in the photograph, and immediately subjected to impact by removing the steel bar holding the weight. This procedure is repeated until six samples have been tested at the selected height.

The criterion for failure is any visible crack or fracture in the specimen's wall. If more than half of the samples fail, the weight is moved down 6 in. for the next set of six tests. If less than half of the samples fail, the weight is moved up 6 in. Impact strength of the pipe tested is reported in foot-pounds, and is calculated from the known weight and height of fall 6 in. less than that required to break more than three of the six specimens tested.

It will be noted that the impact strength calculated from the results of this test is a kind of median value, in that it is the greatest impact which will break half, but not more than half, of the samples tested.

The greatest use for the impact test is as a test for quality of extrusion; but it can be quite useful in comparing one plastics pipe material with another. The low temperature of the pipe in the test tends to magnify deviations from normal quality.

• Miscellaneous tests

Occasionally it is desirable to run an out-of-the-ordinary test on pipe for some specific application. Three of these will be described as typical of this work.

Electrical Short-Circuit Test: In using butyrate pipe as conduit, it became desirable to know the effect of a possible short circuit in wiring inside the conduit. To simulate this situation, a 400-amp arc from an electric welding machine was formed against the inside surface of a section of 4-in. SWP butyrate pipe and continued for 10 seconds. Heat from the arc caused the plastics to blister, char, and roughen. The pipe surface burned momentarily during the existence

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SENSITIVE, AUTOMATIC CONTROL FOR MORE CAPACITY ON LARGE GAS LOADS: Reynolds PL Series Gas Regulators are designed for any type of gas regulation requiring accurate outlet pressure conditions with normal capacities greater than 5,000 cu. ft./hr. Even regulation improves meter accuracy.

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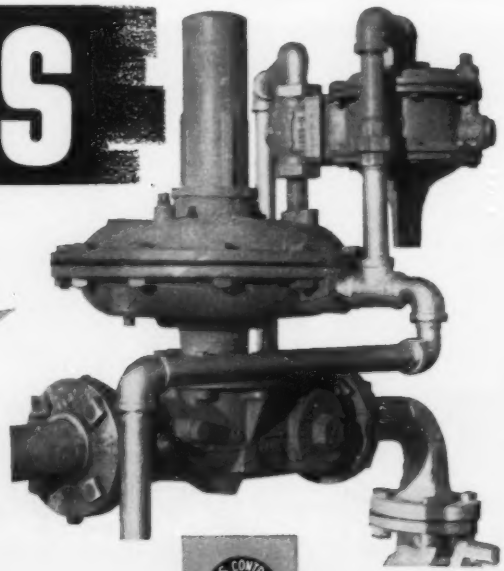


GAS CONTROL SINCE 1892

If It's a Reynolds Gas Regulator, It's RIGHT for the Job

REYNOLDS GAS REGULATOR CO., INC., ANDERSON, INDIANA

A SUBSIDIARY OF ARKANSAS LOUISIANA GAS COMPANY

of the arc, but ceased when the arc was extinguished. The principal interest in such a test concerned the possibility that an internal short-circuit would soften the plastics and allow the conduit to collapse. The test showed that this did not happen.

Minimum Bending Radius: Since butyrate pipe is flexible enough to follow turns in ditches without the use of elbows, it became desirable at one time to determine the degree that it would be possible to bend various sizes of butyrate pipe. The specific question was: What should be the minimum radius of curve of the ditch?

To answer this question, three chemical storage tanks were utilized. The radii of the three tanks were 30 in., 4 ft, and 12 ft. Twenty-foot sections of pipe were bent 90 deg around these tanks, with the results shown below:

Pipe Size	*Radius of Tank*		
	30 in.	4 ft.	12 ft.
2 in. SWP	OK		
2 in. IPS	OK		
3 in. SWP		OK	
4 in. SWP		Buckled	OK
4 in. IPS		Buckled	OK

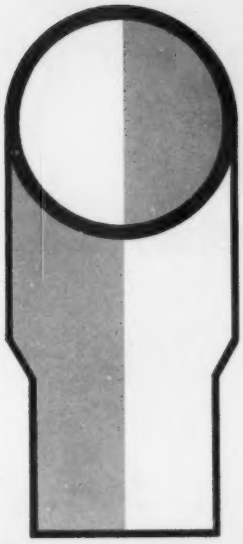
This test illustrates the type of problem which does not need to be run continuously, and which does not justify building equipment with a great deal of precision. Often such tests need to be run only once. An approximate answer is close enough; and the test is run with whatever equipment happens to be readily available.

Crushing Strength: Some butyrate pipe, particularly that intended for use as conduit, is laid in a ditch and covered with concrete. The weight of poured concrete made it desirable to determine if there might be any bad effects from such treatment. Would the pipe be crushed?

The test to determine the answer to this question was not nearly as impromptu as the test just described. In this case, an ASTM procedure was employed. ASTM designation C 14-54 describes a crushing strength test for concrete pipe. While not strictly applicable to plastics pipe, the procedures described in C 14-54 were followed. A three-edge-bearing jig as described in the procedure was constructed from two pieces of wood, 6x6x24 in., and a piece of 4-in. IPS pipe made of formula 265 Butyrate, MH-flow, was crushed between them using a Baldwin-Southwark Universal testing machine in the physical testing laboratory. The pipe was carried to complete collapse with no indication of cracking on either the inside or outside pipe surfaces. The load required was 8000 lb.

• Conclusion

A pipe testing laboratory must be prepared to undertake a great variety of tests, some of which have to be developed before they can be run. Some tests can be run in a few minutes; others require several years. It is a diverse and expensive operation, but it is capable of furnishing necessary design information which cannot be obtained in any other way. ■



GAS COMPANIES—**GLAMORGAN PVC** PIPE WITH BELL ENDS WILL SAVE YOU THOUSANDS OF DOLLARS IN INSTALLATION COSTS

pvc pipe with bell ends makes history

For the first time in Pipe history, GLAMORGAN's new Plastics Division manufactures an IMPROVED Rigid PVC Pipe available with Bell Ends. Joints are connected with ease. You may save up to 50% in installation costs. Two men can now solvent-weld 5000 ft. of 20-ft. lengths of 2 in. pipe in 4 hours. Pipe components solvent-welded make a solid bottle-tight pipeline.

GLAMORGAN through constant research and development is able to manufacture the highest quality rigid unplasticized PVC Pipe. It does what any good PVC Pipe will do and more. PVC is chemically inert. It will not corrode. Pipe walls are mirror smooth, friction free, and flow is up to 20 per cent more efficient. Maintenance costs from electrolytic action, paraffin build up, sulphur and natural gas corrosion, and aging are practically eliminated.

New technical catalogue available on request.

A DIVISION OF GLAMORGAN PIPE & FOUNDRY CO., LYNCHBURG, VIRGINIA

GLAMORGAN PVC meets all requirements of Commercial Standard CS207-60, Commodity Standards Division of the U. S. Department of Commerce.

GAS DISTRIBUTION NEWS

Wants utilities to pick up tab for regulatory costs

NEW YORK'S Gov. Rockefeller proposed that the cost of operating New York's PSC be provided by utility and transportation firms it regulates. He made this known through his budget message to the New York legislature. He did not make known how gas, power, steam service, telephone, railroad and other utilities are supposed to split the cost. However, state budget officials said they expected that an assessment formula would be set up in bills to be introduced.

Rockefeller did point out that about 25 other states "now charge back to the utility companies the whole or a large part of the total cost of operating their public service departments." He said this expense is "clearly an appropriate charge upon the companies rather than a charge upon all state taxpayers."

The proposal is certain to be contested by gas utilities and others.

You'll Sell More Plastex

because Plastex gives you more to sell!

FLEXIBLE PIPE

Plastex Polyethylene . . . in sizes from ½" thru 6" — 75 and 100 psi pressure rated — single and twin-tube types — lengths to 600' — NSF approved.

SEMI-RIGID PIPE

Plastex ABS . . . in sizes from ½" thru 6" — for pressures to 150 psi and even greater chemical and heat resistance — 10' and 20' lengths with plain ends, or sleeve-type coupling one end — NSF approved.

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AND NOW, DRAIN PIPE AND FITTINGS, TOO!

Plastex OX . . . high strength, high impact drain and sewer pipe — in 2, 3, 4, 5, 6-inch sizes — plain and perforated — with sleeve-type fittings for root-proof solvent-weld joints, or dry joints — 10' and 20' lengths.

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THE PLASTEX CO.
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NEGA makes final plans for meeting

On Feb. 4, New England Gas Association's Clark Belden informed us that the final speaker for the 1960 annual meeting had been secured. He is Dr. Carl C. Byers, who will inject humor, education, and inspiration into the gathering with his address: "Get Off Your Launching Pad."

Other highlights of the NEGA meeting will be a display of research hardware from AGA Research, arranged through Lee Robey. Models, pictures, and display boards will be used to show the How, What, Where, and Why of the PAR research program.

Also on tap will be R. N. Papich's (safety manager of AGA) dynamic safety exhibit. Papich has conducted the joint AGA-NEGA safety courses in the past and the AGA display ties in with NEGA's increased emphasis on a broad program of accident-prevention activities during the past several years.

The 34th NEGA annual meeting will be held March 24-25 at the Statler Hilton in Boston.

No tax cuts for "idea" advertising

The government is standing firm on its refusal to permit tax deductions for "idea" advertising. Internal Revenue Service officials have adopted, in spite of bitter protests, new regulations restricting the tax deductibility of advertising for such things as promoting private utilities against government-owned utilities and tax legislation aimed at particular industries.

Thus, in any new gas bill fight, advertisements, handbills, booklets, or other "educational" material put out by either a company or a trade association will not be deductible, nor will contributions to such organizations by companies.

In effect, the new regulations broaden the older definitions of expenses for lobbying, which have never been deductible.

The regulations still permit tax deductions for so-called institutional advertising, espousing a general economic or business theory, as long as no specific legislation in either a state or in Congress is involved.

IRS officials say that under current rules, they have no choice but to ban tax deductions on any expenses which in any way relates even indirectly to legislation, or for contributions by firms to such campaigns.

"If the business interests of the country find that the end result in this area is wrong, their proper resort is to the Congress by way of appropriate curative or remedial legislation," IRS Commissioner Dana Latham commented.

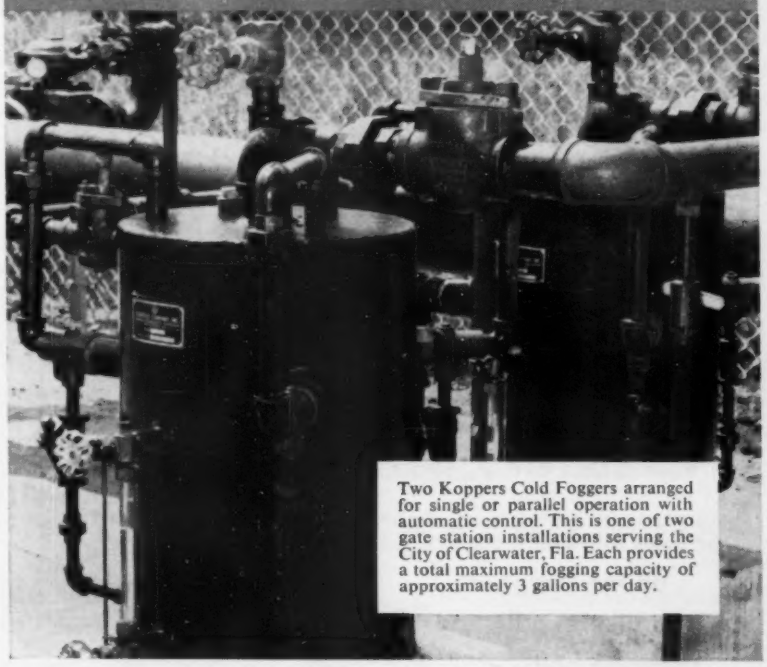
Business, and labor unions which also opposed the new regulation, would have to fight for such remedial laws without the benefit of tax-free advertising.

AGA publishes gas rate book

"Gas Rate Fundamentals" is a definitive book devoted exclusively to gas industry rate fundamentals and practices. The book, published last month, was prepared by the AGA's rate committee.

The 350-page volume represents a collection of papers written by rate specialists in all segments of the gas industry. It was edited by the association's subcommittee on training of rate men.

OIL FOG



Two Koppers Cold Foggers arranged for single or parallel operation with automatic control. This is one of two gate station installations serving the City of Clearwater, Fla. Each provides a total maximum fogging capacity of approximately 3 gallons per day.

to protect gas distribution systems, reduce "unaccounted for" and control dust problems

By introducing a fine oil fog into gas mains, Koppers Oil Foggers reduce maintenance of meters and regulators, condition main joints, minimize leakage, control dust problems and reduce service calls.

Koppers Cold Foggers are available as stock items in capacities as low as 1 gallon per day. Hot Oil Foggers for gas, steam or electric heating, are made in a wide range of capacities, as much as 200 gallons per day. For full information write to: KOPPERS COMPANY, INC., Gas Apparatus Dept., 2003 Scott St., Baltimore 3, Md.

KOPPERS

GAS APPARATUS

Designers and builders of gas holders and gas plant equipment for more than 80 years

Inspection, repair and service of gas holders

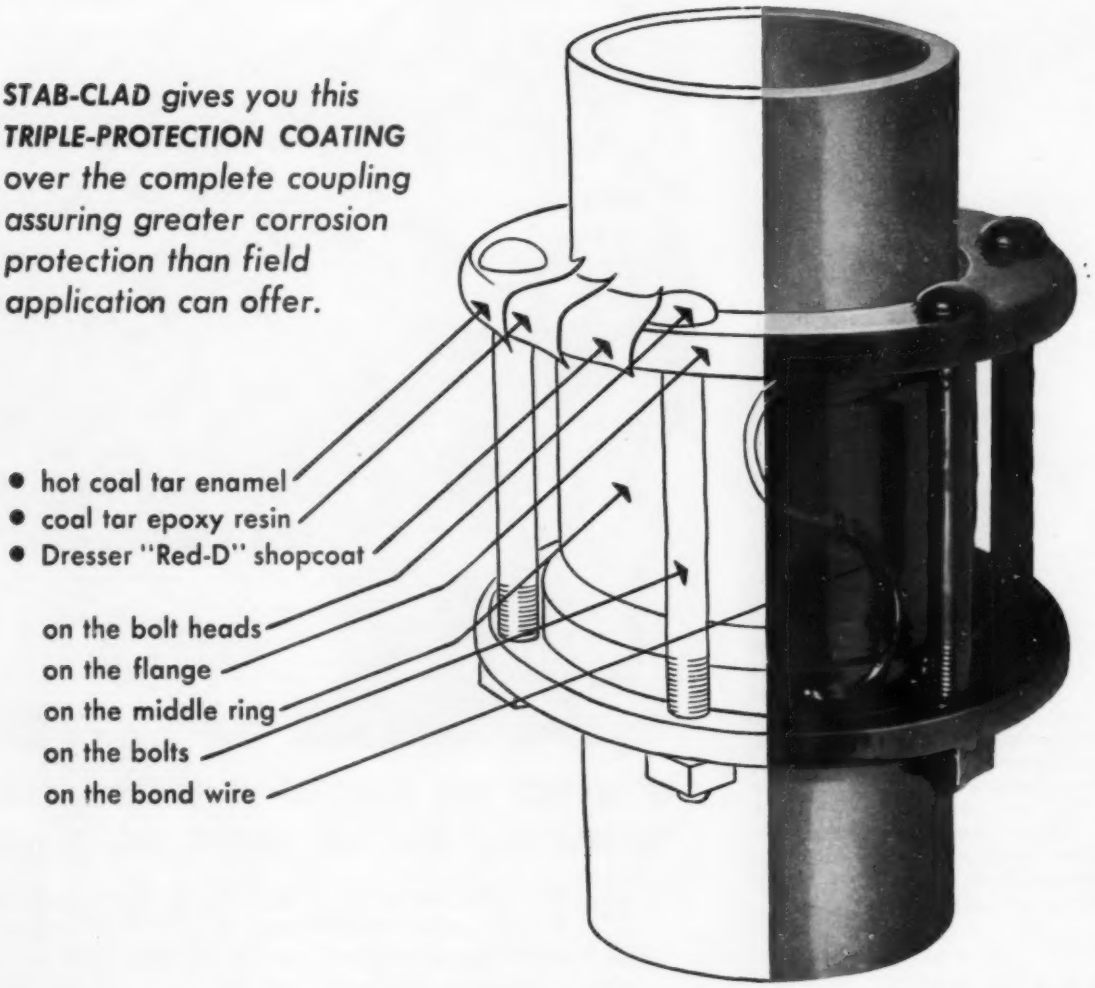
Pre-assembled and Pre-coated

NEW "stab-clad" couplings

Trade Mark Style 123

Revolutionize the installation of coated pipe!

STAB-CLAD gives you this ***TRIPLE-PROTECTION COATING*** *over the complete coupling assuring greater corrosion protection than field application can offer.*


• hot coal tar enamel
• coal tar epoxy resin
• Dresser "Red-D" shopcoat
on the bolt heads
on the flange
on the middle ring
on the bolts
on the bond wire

COATED PIPES can be strung more quickly and safely than ever before with these new Dresser® STAB-CLAD Couplings.

Save the time of on-the-job coupling assembly – for STAB-CLAD is a one-piece unit! When you stab in the pipe ends and tighten the bolts you *immediately* have a finished, permanent connection that is already coated and protected.

Check these facts for yourself by using Dresser STAB-CLAD's on your next coated-pipe installation. You'll agree with those who have found that STAB-CLAD's are a "time and money saver" in performance.

DRESSER
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ONE OF THE DRESSER INDUSTRIES

Bradford, Pennsylvania
Chicago • Houston • New York • S. San Francisco

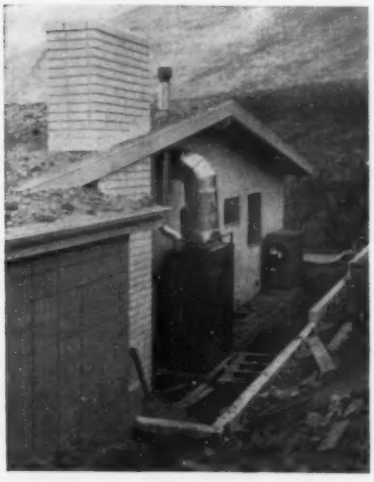
SoCal-SoCounties to sell 1500 Arkla air conditioners

200 going to all-gas tract in San Fernando Valley

Southern California Gas Co. and Southern Counties Gas Co. have undertaken a 1500-unit Arkla gas air conditioner sales quota, and may up this to 1500 additional units before the year is over if sales live up to expectations. This is believed to be the largest single gas air conditioner sales quota ever established.

Simultaneously, officials of the two Los Angeles distribution companies announced that 100 of these air conditioners would go into an all-gas housing tract. Within two years, this tract, Stone Hills in Sherman Oaks, will contain 200 homes, and every one will be gas air conditioned! This is believed to be a record in the western states.

SoCal and SoCounties expect to sell well over the 1500 air conditioners in 1960, combining the Arkla units with the sale of units from other manufacturers. This will more than double last year's efforts, when 700 units were sold. In 1958, the two companies totaled just under 400 units and in 1957, they sold only a little over two dozen.



Air conditioner installed on one of the 200 homes in the Stone Hills Development. Prices range from $40,000 to $45,000, lot value is $10,000 to $15,000. All-gas mood is set by stone entry marker topped by two gas lights. Luxurious features of the homes include back-to-back fireplaces, and house-length covered terraces.

These ambitious plans mean the two companies will have to realign and increase their air conditioner sales staffs. So far, residential sales have had a slight edge over commercial, although commercial installations frequently have more than one unit in a single job.

The two companies are confident about 1960 sales. They point to December of 1959 when in a two-week period sales were at a high point for the year. They quickly state that December was the wind-up of a sales contest, but they also proudly point out that it was also the height of the Christmas season (when most consumer money is funneled into gifts, not major household expenditures) and the height of the "off" season, since air conditioners aren't needed in December, even in California.

First deliveries on the Arkla units have already begun. Deliveries include both the 3½ and 5 ton units of the "Sun Valley" heating and cooling type. However, Arkla unveiled a remote air-conditioner-only model in mid-January and under the quota arrangement this model may be substituted for some of the other units. Almost all of the equipment on this model can be located outside the house greatly adding to the flexibility of installation.

SoCal and SoCounties, it should be noted, do not actually sell air conditioners, but serve somewhat in the capacity of manufacturers' agents. Under this arrangement the availability of units to local dealers is assured by the gas utilities, supported by active local promotional programs. The local dealers remit payment on units sold directly to Arkla. The idea is rather unique among the nation's utilities, but SoCal and SoCounties say that by working in full cooperation with the dealers and assisting them, a greater volume of air conditioning sales are made.

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COUPLINGS

STYLE 38

INSULATING
COUPLINGS

STYLE 39

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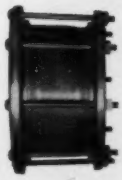
COUPLINGS

STYLE 62



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Bradford, Pennsylvania

this certificate is proof

Southern Cross Foresters presents this Safety Certificate upon completion of each leakage survey.

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In addition to the public relations value, the survey this certificate represents will prove a positive guide to the reduction of costly unaccounted-for.

Employing the latest Vegetation Methods and electronically instrumented Safety Surveys, SCF can take care of all leak location problems.

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SOUTHERN CROSS FORESTERS

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Advantages of investor-ownership presented in booklet

A brand new edition of "What Everybody Should Know About the Advantages of Investor-Owned Gas Companies" has been produced by PAR Public Information. This booklet tells and sells the story of investor ownership by delineating the merits of competitive enterprise and pitfalls of government ownership.

Since its original printing two years ago, it has widely circulated to gas company employees, stockholders, customers, and molders of public opinion. In the new edition, the facts and figures are brought up to date.

AGA's Order Department at 420 Lexington Ave., New York 17, will be glad to take your order. Prices: under 100, 10 cents each; 101 to 2000, 9 cents each; over 2000, 8 cents per copy.

"Wrinkle" ideas sought for measurement course

All persons working with gas measurement and pressure regulation are invited to submit new ideas of any type relative to those subjects. They will be presented to a "Wrinkle Class" at the 1960 Southwestern Gas Measurement Short Course at Norman, Okla., April 19-21. Texas Eastern's genial Pat H. Miller has called for entries prior to March 1, but since that will be cutting it a mite close, we assume he'll accept them a wee bit later than that.

New ideas in design of equipments, parts, repairing, operating techniques, calculating, testing, accounting, new sets of standard conditions, etc., etc., will be most welcomed for the Wrinkle session. Pat urges you not to be a spectator, but to bring your ideas along so that you can join the fun and further the progress of the arts. Send wrinkles to Rogers Thompson, Texas Eastern Transmission Corp., P. O. Box 1612, Shreveport, La.

When submitting a wrinkle, please include a drawing (black and white) if necessary for clarity. Also, keep the description simple but specifically explain the purpose, necessity and method of use or operation. Include names of person or persons who should be given credit for the creativity.

Flexible tubing to cross Canadian waters

NATURAL GAS will flow to Vancouver Island in British Columbia through a unique flexible alloy cable. The British Columbia government gave the go-ahead to Magna Pipeline Co. to install the line under the Gulf of Georgia.

Some conditions were attached to the approval: By May 1, Magna must have a firm contract with a pipe manufacturer. (Present plans call for the cable to be made by British Callenders Cables Ltd. of England.) A firm gas contract must be signed with Westcoast Transmission Co. Magna must file financing details with the government. Also, the line must be finished by June 30, 1962.

Underwater sections of the crossing will be made with cable normally designed to transmit electricity.

The certificate gives Magna the right to construct and operate the line from the mainland and to sell gas to industrial users and public utilities on the Island as far north as Nanaimo. Initial stage of development will cost Magna $12.6 million, including the pipeline to Nanaimo and Victoria. Also covered is a 3000-hp compressor station on the mainland.

Actually, there will be four 4.85-in. flexible submarine crossings: from the mainland to Galiano island, from Galiano to Salt Spring Island, from Salt Spring across Stuart Channel to Vancouver Island, and from Bamberton on the Island across Sannich Inlet to Brentwood.

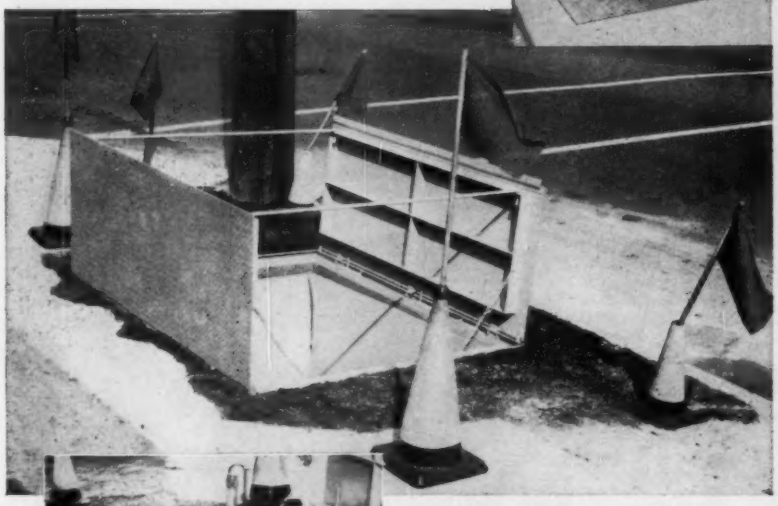
The first stage of the project will be capable of delivering 23.5 MMcf per day.

B. C. Electric Co. Ltd. will build a $12 million distribution system in Greater Victoria when gas reaches the island. Magna plans to sell the gas to B. C. Electric on the island at 60 cents per Mcf. Price of gas from a competing applicant, Island Transmission Co., would have been 65 cents.

Crane expands

Crane Co., Chicago, has purchased the business and assets of the Swartwout Co., Cleveland manufacturer of electronic controls. Swartwout will operate as a Crane division.

easiest access to regulators under-the-sidewalk



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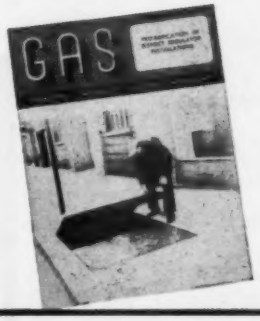

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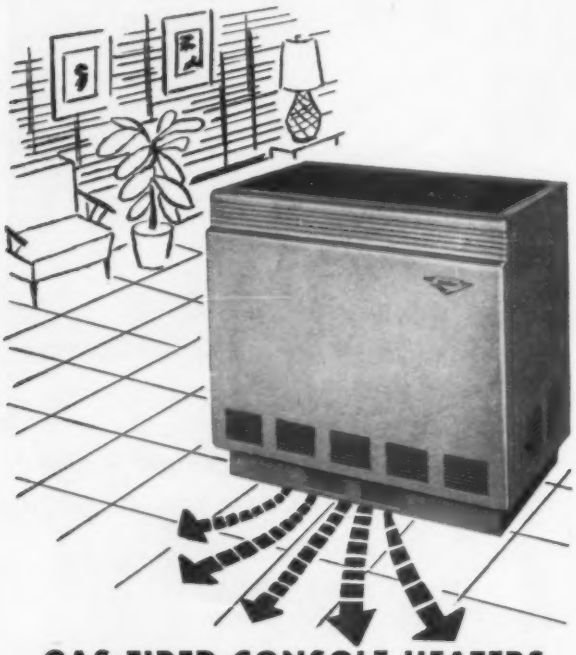

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Furnaces as small as refrigerator coils foreseen

A HOME furnace that may be no bigger than a refrigerator coil is envisioned by Wallace K. Sheppard, utilization engineer for Peoples Natural Gas Co. in Pittsburgh. He bases his belief on information from H. T. Gilkey, director of technical services for the National Warm Air Heating & Air Conditioning Association.

According to Gilkey, the furnace heat exchanger can be made a great deal smaller as a result of some new developments. He points to the work done recently in developing methods of catalytic combustion, using gaseous fuels.

"One device," he said, "consists of a porous ceramic tube into which a gas-air mixture is fed under pressure. After the mixture has been ignited on the outside of the tube and the tube has come up to temperature, essentially flameless combustion is maintained.

"The tube glows and has a surface temperature of 2000 deg. That gives you heat to warm the air that is fanned through your house."

Gilkey said another device uses a stainless steel tube.

"Thus, dimensions of the new furnace could be about half the size of a present-day compact warm air furnace and the efficiency could be increased 10 to 12 per cent. Chimney requirements would be reduced as well," he added.

The new equipment will not be on the market for several years. "Controls, valves, and fans must be developed to go along with the projected furnace. The things we must accomplish are simultaneous control of temperature, humidity, cleanliness, and distribution of the air. The objective is comfort for the occupants."

According to Gilkey, the principal fault of unsatisfactory heating systems is in the distribution of the air—inadequate design and improper installation.

Superior enlarges plant

Superior Meter Division of Neptune Meter Co. is increasing its manufacturing space at its Brooklyn (N. Y.) factory. Streamlining of the plant's operations and increased manufacturing activity made it necessary to almost double the amount of factory space.

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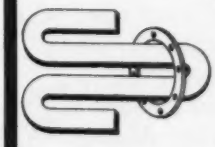

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Gas rate inquiry ordered in Miami

Miami, Fla., has launched a full-scale probe of the Houston Corp.'s gas system in the city. The city commission called for a surrender of Houston's books and records for auditing.

The commission's action arose from its resentment over the company's refusal to agree to a franchise.

Houston serves 18,000 Miami customers. The minimum gas rate went from $1 to $2 when Houston started service last July; its rate base was temporarily sanctioned by the state. This is slated for review next July.

Miami's Junior Chamber of Commerce has been seeking a public hearing before the Florida Railroad and Public Utilities Commission. Houston reportedly has figures to win an even higher rate.

Old coal mine ready for gas

Public Service Co. of Colorado is now able to withdraw up to 15 MMcfd from its storage area in an abandoned coal mine near Arvada, Colo. Installation of the last of three Worthington compressors completed the job. Indications are that the conversion of the old coal mine into a storage area for 3 billion cu ft of natural gas has been successful. Testing has been satisfactory to date and is continuing on schedule. This phase will cost about $352,000. If tests continue satisfactory, additional development work will run about $5.2 million.

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Agricultural area gets gas supply

Rio Grande Gas Co., Dallas, has permission to provide gas service to agricultural areas between Las Cruces and Radium Springs, N. M.

Rio Grande plans a pipeline from a connection with El Paso Natural's mainline, 15 miles south of Las Cruces.

Service will include piping gas to several hundred irrigation wells in addition to domestic service. Not covered in the permit is gas service to Las Cruces, which is served by a municipal gas system.

Representatives named

Kraloy Plastics Pipe Co., Los Angeles, has announced the following manufacturers' representatives: Richard Alt, Milwaukee; Arthur B. Anderson Co., Minneapolis; Courtney & Associates, San Francisco; Fuller Engineering-Sales Co., Kansas City, Mo.; Mack Co., Houston; Wells Rutherford Inc., Denver; Steele & Associates Inc., Atlanta, Ga.; Wm. B. Wickersham & Co., West Newton, Mass.; and Stuart Steel Protection Corp., Plainfield, N. J.

Plant capacity tripled

Naugatuck Chemical Division of United States Rubber has more than tripled the capacity of its marvinol vinyl resin plant in Painesville, Ohio, since its acquisition 10 years ago. An additional expansion program now under way will raise the plant's capacity by more than 30 per cent.

Following conversion to natural gas, the west coast division of Peoples Gas System in Tampa, Fla. is "ringing the town" with a series of illuminated spectacular bulletin boards. Eye catcher in this one is the blue flame that moves up and down above the woman's hand. This particular sign stands directly across the street from the main entrance to Tampa Electric Co.'s new general office building.

Research report issued

The AGA Committee on industrial and commercial research has issued a report on "The Influence of Convection and Radiation in the Over-all Heat Transfer of a High Temperature Gas-Fired Industrial Furnace."

The report should be of interest to industrial gas sales engineers, furnace manufacturers, and plant operators in the metal-working field.

It is available from the association for $2 per copy.

Pratt & Whitney in fuel cell field

Pratt & Whitney Aircraft is expanding its operations to developing and manufacturing highly efficient fuel cells.

A joint research and development program covering the entire field of the fuel cell has been entered into by Pratt & Whitney and Leesona Corp.

Pratt & Whitney will be responsible for mechanical and systems development, manufacture and sales.

Lessona and the National Research Development Corp. of London will carry on the chemical and electro-chemical research.

The fuel cell is a power plant which converts chemical energy into electricity directly within itself without the need of conventional electrical generators. This is done at about one-half to two-thirds the fuel consumption rate of the best diesel-electric and steam turbine-electric systems, according to company spokesmen.

The fuel cell employs hydrocarbon fuels, such as propane or kerosene, with air as its oxidizer. Uses for this particular cell would be as a power source for industrial power generation, vehicle propulsion, electric welding equipment, and similar types of applications where the cost of producing electricity is an important factor.

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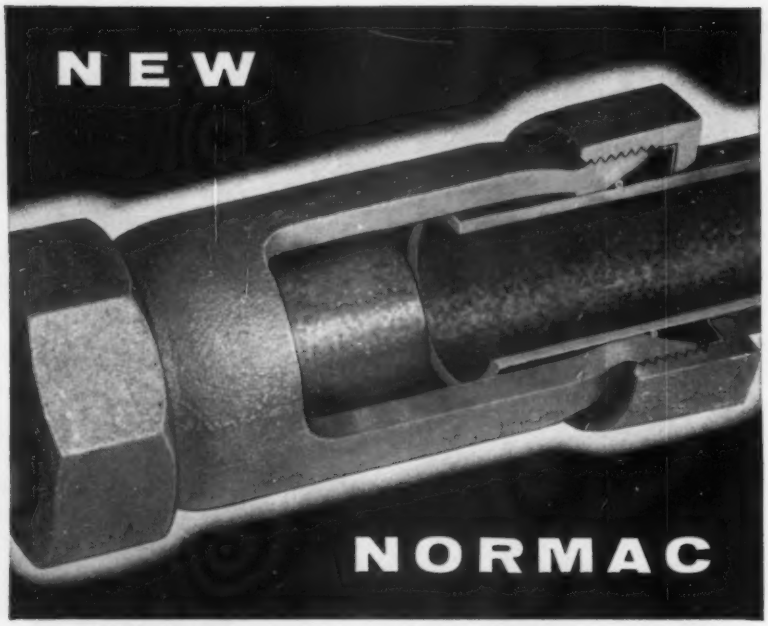

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Milwaukee Gas plans new service center

Milwaukee Gas Light Co. plans to build a $1.4 million service center on the southwest side of Milwaukee. Operations at the center will include reporting stations for the customer service department, field engineering division, and construction and repair departments and storerooms.

Construction of the 103,600-sq ft building is slated to start late this spring, with completion and final landscaping to be finished early next year.

Dust and lint studied

Factors influencing dust and lint collection on the underside of burner ports are discussed in a report from the AGA Laboratories. Also covered are methods for reducing this tendency through burner design. Research Bulletin No. 79, "Minimizing Lint Stoppage of Atmospheric Gas Burner Ports," will be available in April. Cost: $2.50.

Heating and cooling

Natural gas supplied by Southern Union Gas Co. will heat and cool New Mexico's tallest building, the 14-story Bank of New Mexico. Now under construction, the building will have one of the largest refrigerated air conditioning systems in the state. The Trane cooling equipment will use low pressure steam generated by gas to produce chilled water for air conditioning.

GAS • ASSOCIATIONS

AGA joins in promoting Silver Shield program

A nation-wide program to boost sales of top-quality heating and air conditioning installations has won gas industry recognition. And, it will be promoted by the AGA. The program is the Silver Shield effort of the National Warm Air Heating & Air Conditioning Association.

The Silver Shield program is aimed at creating greater demand for completely installed forced air heating and cooling systems, guaranteed as to comfort and performance and identified by the Silver Shield emblem.

The emblem on such systems certifies compliance with design, installation and performance standards set up by the heating association. These standards are incorporated in the Federal Housing Administration's Minimum Property Standards, as well as in many municipal codes through the U. S.

Annual GAMA meeting set for White Sulphur Springs

GAMA's annual meeting is scheduled for March 30-April 1 at The Greenbrier in White Sulphur Springs, W. Va.

Division meetings have been set up for morning and afternoon on the first day, morning of the second day, and morning and afternoon of the third day.

The first general session luncheon will be held on Wednesday, March 30. Reports will be presented and officers elected during this session. Thursday morning will feature the traditional AGA general session breakfast. A second general session breakfast is scheduled for Friday, April 1.

Dallas scene of 16th NACE meeting

The 16th annual conference of the National Association of Corrosion Engineers will be held in Dallas, March 14-18. Of special interest to the gas industry will be nine technical papers on pipeline corrosion and its control.

Five of the papers will be presented in the pipeline general symposium. The other four will be given at the cathodic protection symposium.

New officers to be installed on the last day of the conference are: president, George E. Best, Manufacturing Chemists' Association, Washington, D. C.; vice president, Edward C. Greco, senior research chemist, United Gas Corp., Shreveport; treasurer, C. G. Gribble Jr., district manager, Metal Goods Corp., Houston. Starting a three-year term as a director will be J. S. Dorsey of Southern California Gas Co., Los Angeles.

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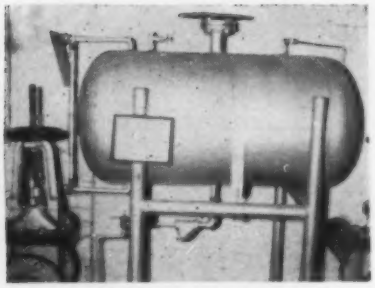
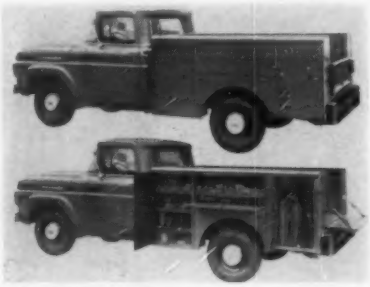
New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 117, 118



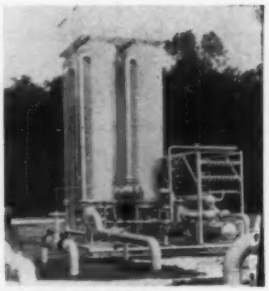
1. City gate odorizer

Southern Manufacturing's direct application odorizer uses the pressure drop across an orifice to vary injections. Odorant of any type is stored in a suitable tank. Amount injected in line is shown by liquid rotameter. This eases direct visual check of odorant usage and provides a means for immediate control of amount used. *GEC-590*
Southern Manufacturing Engineers



3. Utility bodies

A new line of job-planned utility bodies, redesigned for the 1960 Ford chassis, has been introduced by Reading Body Works. Reading reports that its 1960 line of bodies has been lowered 2 in. By reducing body height dimensions, the center of gravity has been lowered, thus affording smoother riding and greatly increased maneuverability. *GEC-790*
Reading Body Works Inc.

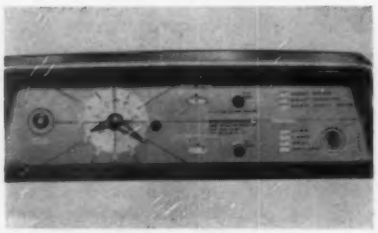


5. Processing plant

Delta's new simplified processing plant recovers both natural gasoline and LPG from either rich or lean natural gas streams. The packaged plant consists of a four-tower closed regeneration system incorporating fractionating and refrigeration equipment. Absorbent beds of both silica gel and activated carbon are used in the Dryex gasoline plant. *GEC-300*
Delta Tank Mfg. Co.

2. Two-way radio

The mobile radio department of Allen B. Du Mont has introduced Transicom, a medium power transmitter-receiver. This compact unit is for mounting under the dashboard of motor vehicles. According to Du Mont, the new radio sets use a blend of transistorization and other semi-conductors together with vacuum tubes to achieve a design as maintenance-free as possible. *GEC-140*
Allen B. Du Mont



4. Gas range

Featured in the 1960 Magic Chef gas range line is the Magic Control Center, introducing Dial-a-Magic roasting control. This device figures the necessary cooking time and turns the oven on and off. The homemaker can set the time she wants to have dinner, dial the weight and variety of meat, and the device computes the needed cooking time and controls the oven accordingly. *GEC-240*
Magic Chef

6. O-ring closure

Sillers Engineering has a new simplified O-ring closure for filters, strainers, blowdowns, scraper traps, manways, etc. The design incorporates an O-ring seal to achieve bubble tight seals regardless of fluid pressure. Another new feature is the location of the seal on the outer edge and the dovetail groove which make it easier to insert the O-ring and to hold it in place. *GEC-390*
Sillers Engineering Co.

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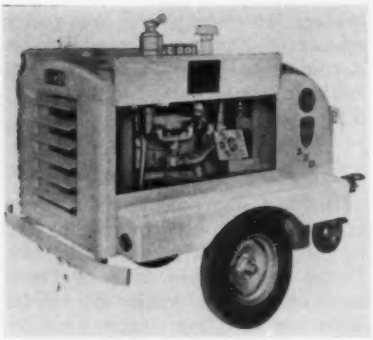


7. Portable compressor

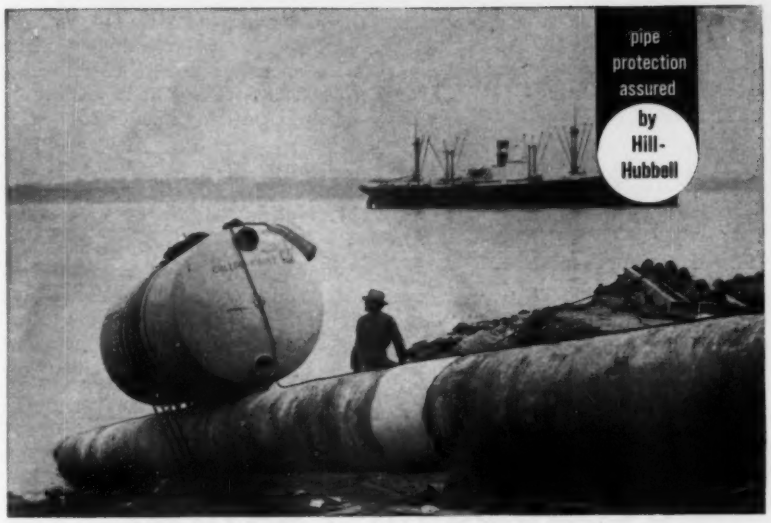
Three safety features have been added to Le Roi's 125RG2 portable rotary compressor: (1) a cut-off switch automatically shuts down compressor if engine oil pressure drops too low; (2) an automatic dump valve instantly releases air pressure in receiver when compressor is shut down; and (3) a non-wearing orifice assures proper air-end oil cooling. Model 125RG2 is a 125-cfm, gasoline driven two-stage unit. *GEC-010*
Le Roi Division

8. Work station

A mobile, self-contained work station from Remington Rand is for use with all makes of shelf-filing. The station is called a "mobile shelf filing truck." Correspondence to be filed and to be pulled from shelves is handled in one operation. *GEC-600*
Remington Rand

9. Signaling decoder

Motorola's new transistorized Quik-Call selective signaling decoder is for use with its mobile two-way radios, including the transistorized MOTRAC radio. The Quik Call system enables a radio dispatcher to alert and talk to individual mobile units in his network without bothering other vehicle operators. *GEC-140*
Motorola Inc.



vital narrows crossing *fully protected*

This underwater pipeline across New York Harbor "Narrows" will serve Brooklynites for many years, thanks to optimum corrosion protection applied by Hill-Hubbell.*
Underwater or underground, long, trouble-free service is assured if you specify Hill-Hubbell — the name synonymous with quality in mill coated-and-wrapped pipe.

*Pipe in photo weighted with concrete covering over Hill-Hubbell protection.

Specify Hill-Hubbell wrapped pipe on your next job . . .

HILL·HUBBELL
DIVISION OF GENERAL PACIFIC CORP.
2091 MAYFIELD RD. • CLEVELAND 18, OHIO • YELLOWSTONE 2-7535

10. Air compressor

A new model, 600-TC, is now offered as the standard 600-cfm unit in the Schramm line of Unistage portable air compressors. The compressor will deliver its full 600 cfm of air at 100 psi even under continuous operation at altitudes as high as 10,000 ft. The unit has a low operating speed of 1200 rpm. *GEC-010*
Schramm Inc.

11. Holiday detector

Tinker & Rasor's Model M-1 is a non-destructive holiday detector. Its applied voltage never exceeds 67½ v at any time. The inspection electrode consists of a cellulose sponge which, when dampened with water, is moved over the coated surface. When the electrode passes a void or bare spot, a bell rings to indicate the holiday. *GEC-110*
Tinker & Rasor

12. Rotary Compressor

Davey Compressor's 1960 rotary compressor models of 20-hp and larger are equipped with new Perma-Vane rotor blades. These new blades are made of special light metal alloy which readily transmits heat through its entire mass. According to Davey, many Perma-Vane blades operate 15,000 hr without servicing. *GEC-010*
Davey Compressor Co.

Clean, efficient operation with no corrosion... PANTHER PLASTIC PIPE FOR GAS MAIN & SERVICE LINES

PANTHER®

Panther Plastic Pipe for natural gas installations is made of tough, ABS Kralastic and is ideal for mains, and new services. It is not recommended for distribution of gas which contains aromatic hydrocarbons. Panther Pipe is a brilliant blue for quick identification.

Panther Pipe is extruded to committee recommendations of the American Gas Association and the Society of Plastics Industry as to weight, dimensions and tolerances.

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1897 1960

PIPE STOPPERS OF ALL KINDS

SAFETY GAS MAIN STOPPER CO. INC.

GOODMAN
USED SINCE 1897
2" HANDLE & LOCKING SLEEVE
GAS MAIN STOPPER

523 Atlantic Avenue
Brooklyn 17, N. Y.
Cable Address GASTOPPER, N. Y.

13. Built-in gas oven

A new five-model line of Universal built-in ovens and ranges is being introduced by Waste King. Clean styling, simple, easy-to-use control panels and full-width oven doors are featured. The top-of-the-line Imperial model offers clock-controlled baking and roasting simply by dialing the weight of the roast and the time the user wishes it turned off. All units come in a choice of white or five colors. *GEC-240*
Waste King Corp.

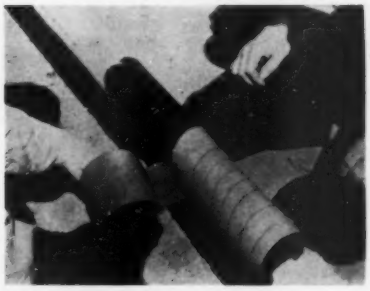
14. Gas refrigerator

Norge's new gas refrigerator (CTGI-110) is a 13-cu ft box with

an automatic ice-server and a "food-freshener" coil. With Never-D-Frost, the refrigerator section need never be defrosted. Customatic cold system maintains correct temperatures. *GEC-690*
Norge Division

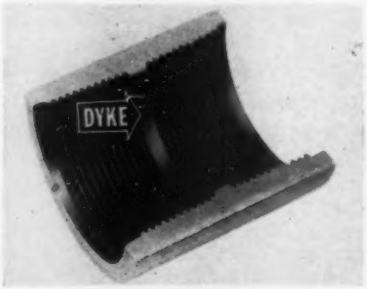
15. Tone-squelch device

A new type of tone squelch device, completely transistorized, helps two-way radio users avoid hearing messages other than those of their own system. General Electric has added this device to its Transistorized Progress Line. The new equipment contains no relays nor electromechanical devices. *GEC-140*
General Electric



16. Tape wrap

A new corrosion-resistant tape for wrapping joints of plastics-coated steel pipe is available. The tape and a primer are added to Republic Steel's line of plastics-coated steel pipe to form a complete pipe package. X-Tru-Tape serves to protect exposed ends of the X-Tru-Coat pipe, which is supplied "cut back" to allow welding. The new product comes in 1-, 2-, and 4-in. widths in 100-ft rolls. *GEC-130*
Republic Steel Corp.

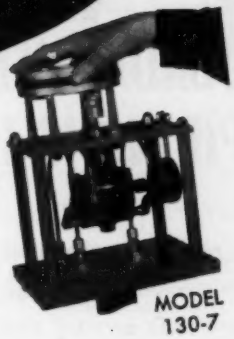


17. Insulating couplings

Conley's couplings stop electrolysis and corrosion where dissimilar metals, stray currents, soil conditions, and chemicals are contributing factors. They are made of fiberglass reinforced epoxy. Features include integral dyke, preventing

ARCCO

Arcco-Anubis
CONTINUOUS GAS SAMPLER



MODEL 130-7

FOR OBTAINING REPRESENTATIVE GAS SAMPLES TO DETERMINE CHEMICAL AND PHYSICAL PROPERTIES OF GAS.

For obtaining more accurate gas sampling, this proven Arcco-Anubis instrument is unexcelled. It replaces older, inadequate methods for spot sampling. This sampler will over a period of seven days accumulate at a constant rate a sample of gas to a final pressure at or near 130 psig from a sample source, the minimum pressure of which is not less than 150 psig.
Models for many other pressure ranges and sampling periods now are available.

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7142 East Condor Street, Los Angeles 22, California

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PVC - KRALASTIC
BUTYRATE - CYCOLAC -
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● We specialize in the joining of plastic materials. Write for information regarding your specific application.

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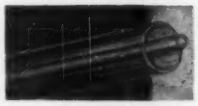
BUSADA BUTYRATE (PLASTICS) GAS PIPING IS IDENTICAL!

IT'S CLEAR! YOU CAN SEE IT'S BY Busada

It is transparent . . . made from one specific material formulation containing the same physical properties shipment upon shipment. Its high quality is constant. Made to same O.D. as steel pipe with 2 wall thicknesses. Close tolerances insure leakproof, trouble-proof ease of installation. Complete line of fittings.



Butyrate pipe now available in black

Made by Busada Mfg. Corp., for

BUSADA SUPPLY CO. INC. 32-21 DOWNING STREET FLUSHING 54, NEW YORK

Representatives in: Boston, Los Angeles, Shreveport, La., Kingsport, Tenn., Grand Rapids, Mich.

90% cut in operating and maintenance cost means

CASH in the BANK for you!

New, transistorized M-SCOPE PIPE FINDER only $189.50

Rugged, transistorized construction practically eliminates maintenance cost . . . extends battery life to a year or more. Pinpoint accuracy, greatest depth penetration make the M-scope first choice in the field!

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FISHER Research Laboratory, Inc.

Dept. G-4, Palo Alto, Calif.

NEW Arno PIPE-WRAP TAPE

Positive Protection for Buried Pipe

Here's pipe protection by the roll. Pipe-Wrap is made of stretchy, inert polyethylene with a pressure-sensitive adhesive to provide a tough, continuous barrier against rust, acids, alkalis and electrolytic currents. Saves time and money.

MANUFACTURERS AGENTS WANTED FOR SOME SELECTED AREAS

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Dr. Scholl's Adhesive Tape Division

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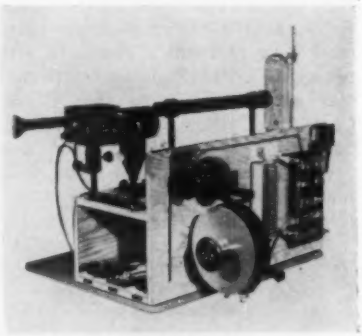
metal-to-metal contact; positive mechanical break to galvanic action; and heavy walled laminated structure, allowing pipe wrench installation. *GEC-370*
Conley Plastic Corp.

18. Split-channel checks

Lampkin has a system for measuring the frequencies of mobile-radio transmitters to the FCC split-channel tolerance of 0.0005 per cent (above 50 mc). The system, called the PPM package, consists of the Lampkin micrometer frequency meter and a modified crystal calibrator. When used in conjunction with a WWV receiver, transmitter-frequency checks can be made to an accuracy of better than 1 part per million. *GEC-140*
Lampkin Laboratories



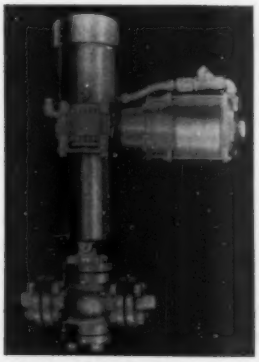
19. Calibrating set

Pyro Instrument's Model 107 optical pyrometer calibrating set simultaneously calibrates any two optical pyrometers irrespective of make. The totally packaged set comes with a Certificate of Calibration obtained from equipment calibrated at the National Bureau of Standards. *GEC-540*
Pyrometer Instrument Co.

20. Pocket case

A new, lightweight leather pocket case holds engineer's slide-rule, pen and pencil firmly in shirt

or coat pocket. A compartment, in the back holds notepad, etc. The steel clip is encased in leather. The slim Rule-Wallet is furnished in pigskin. *GEC-770*
Remco Products



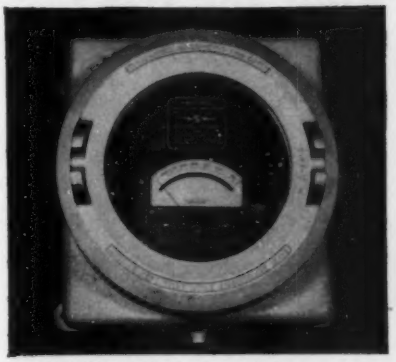
21. Valve operator

An electronic process control valve operator has been introduced by the electronics division of Industrial Process Engineers. The new operator employs neither hydraulic nor pneumatic elements. Motor starting, stopping and reversing control are completely electronic in operation. There are no mechanical switches nor relays. Response is without valve position hysteresis. *GEC-750*
Industrial Process Engrs.

22. Plastics tape

A chemically inert plastics tape has been designed to seal and to

HASTINGS GAS FLOWMETER



Model FI-6 Indicator in explosion-proof case.

Type S-16B Gas Flow Probe

RANGE AND CALIBRATION — The indicator is furnished with a linear scale from 0-200. Calibration curves are available for air over the range from 25-6,000 feet per minute at S.T.P. or from 2-450 pounds per minute per square foot of cross sectional area. The greatest accuracy, however, is in the lower portions of these ranges, principally, from 75 to 1,000 feet per minute at S.T.P., and from 4 to 75 pounds per minute per square foot of cross sectional area. Calibration curves can be determined for most other gases and gaseous mixtures.

UL

APPROVED FOR Class 1, Group D HAZARDOUS LOCATIONS

This electrical instrument is the first of its type to be UL approved for use in the presence of certain flammable and explosive mixtures, Class 1, Group D. Indicator furnishes continuous, direct indication of mass flow in gas lines. 115-Volt 60 Cycle operated.

- EASILY INSTALLED — No orifices, Flanges or By-Pass Required.
- NO CORRECTIONS needed to compensate for temperature or pressure variations.
- CONTINUOUS DIRECT INDICATION.
- EXTREMELY SENSITIVE. Can even detect leaks in valves and control units.

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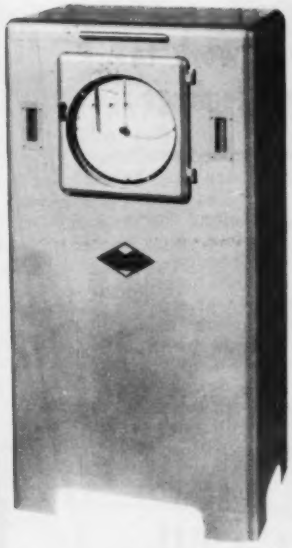
THE ORIGINAL **AC-ME**

RECORDING GRAVITOMETER



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- Provides Permanent Record of Specific Gravity of Gas
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- Automatically Compensated

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Using Plastic Pipe for Gas?

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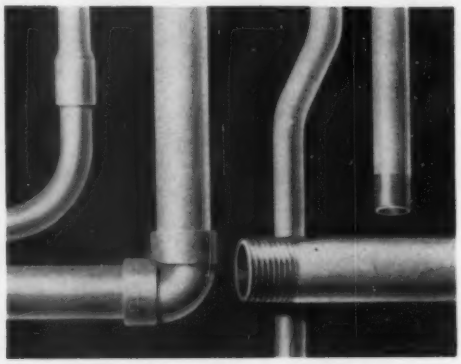
Rigid Unplasticized Polyvinyl Chloride PVC Pipe, Tubing and Fittings.



Quality, Service, Dependability and *Satisfaction* are the benefits you will receive from the following features of Easton PVC material in the handling of natural gas installations.

1. Extruded from high grade PVC resins.
2. Quality controlled for dimensional stability.
3. Resistant to corrosive soil conditions.
4. Resistant to galvanic action.
5. Non-Electrolytic.
6. High efficiency in flow characteristics due to smooth interior surface.
7. High tensile and impact strength.
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Call or Write for detailed information and specifications.

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Modern Methods developed by HEATH give you new Safety Survey work to control leakage . . .

Mobile Infra-red analyzer (IR units) are used to make your Heath Leakage Control Survey more complete. New Auto-Test-Inserts ("A-T-I" units) used in downtown areas, further improve the Safety factor.

Write for information about Heath Surveys to meet your special needs.

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for leakproof, pressure-tight connections

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SEALING COMPOUNDS

Heat and vibration-proof, non-solvent, will not shrink, crack or crumble. Makes all assemblies leak-proof and pressure-tight. Prevents rust, corrosion, joint seizure.

7 BASIC BLENDS

LIQUID WRENCH

The super-penetrating rust solvent

LOOSENS rusted bolts, nuts, screws, 'frozen' parts

Liquid Wrench works *fast* ... yet is absolutely safe for all metals and alloys.

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SOLDER SEAL

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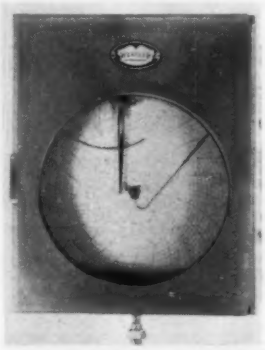
Charlotte, North Carolina

permanently lubricate threaded and coupled pipe joints. Called Scotchrap brand Dry Thread Sealer 4212, this unfused film can be applied in seconds. It conforms to all types of pipe threads and fittings in any pipe system. *GEC-730*
Minnesota Mining & Mfg.



23. Recording instruments

Easy reading and dependable accuracy are featured in the new Weksler line of temperature, pressure and humidity recording instruments. The instruments are contained in completely redesigned aluminum cases. They are available in 8-in. chart size with one- to three-pen systems; in 10-in. or 12-in. chart sizes with one- to four-pen systems; and in hand-wound or electric chart drives for 12-hr, 24-hr, 7-day, and 31-day revolution. *GEC-540*
Weksler Instruments Corp.

24. Air compressor

Winslow Manufacturing is producing a complete line of portable, oil-free, piston-type air compressors. According to the company, compressor design assures maintenance-free operation by eliminating lubrication and diaphragms that rupture. The 18-lb compressor measures only 10 in. long by 5¾ in. wide by 9½-in. high. *GEC-010*
Winslow Manufacturing Corp.

TRADE LITERATURE

25. Plastics pipe

Kraloy has published a 36-page handbook for engineers. It contains pertinent and detailed information on the use of Kraloy PVC plastics pipe, fittings, and valves. Specification, design, and installation information is included as well as a comprehensive corrosion resistance comparison chart. *GEC-630*
Kraloy Plastic Pipe Co.

26. Turbocharged compressor

Clark's redesigned line of turbocharged HRA-T gas engine-driven compressors is covered in Bulletin 179. Described and illustrated are the crankcase, bed section, pistons, crossheads and running gear, all of which have been made heavier and more massive to handle the added hp developed from turbocharging. *GEC-160*
Clark Bros. Co.

27. Air filters

A new composite product bulletin from American Air Filter describes the construction and application of permanent washable unit air filters. Bulletin 207 covers four types of filters and includes explanations of filter maintenance methods. *GEC-350*
American Air Filter Co.

28. Generating plants

A 4-page bulletin (F-147) from Onan is comprised entirely of photos showing typical installations of Onan emergency electric generating plants in the New England area. The 2-color folder pinpoints the need for standby electric power in commercial, public and institutional buildings. *GEC-170*
D. W. Onan & Sons Inc.

29. Electronic computer

Complete specifications on the new RPC-4000 electronic computing system are given in Catalog S-482 from Royal McBee. The RPC-4000 is a fully transistorized, electronic, stored program, general purpose computing system for both engineering and business data processing. *GEC-180*
Royal McBee Corp.

30. Process equipment

Allis-Chalmers has published a catalog guide of equipment for the process industries. Included in form 25C6177P are descriptions of compressors, vacuum, centrifugal, axial flow and turbine pumps, and valves for fluid flows. *GEC-450*
Allis-Chalmers Mfg. Co.

31. Leak detector

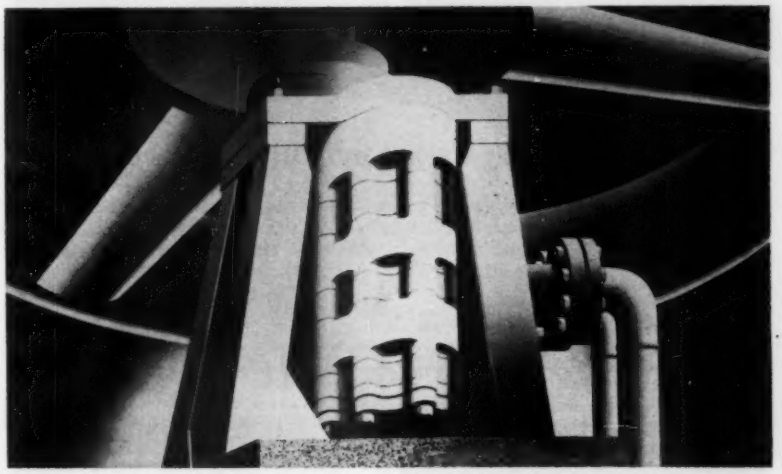
Descriptive literature is available on Detect-A-Leak, a nonflammable, non-corrosive liquid. When applied to pressure lines, tanks, or pressure vessels, Detect - A - Leak forms large bubbles which remain intact until the danger spot can be marked for repair. *GEC-760*
Flamort Chemical Co.

32. Compression couplings

Joslyn has issued bulletin JF-106 covering its line of compression couplings. The 8-page catalog contains photos, descriptive information and specifications on the couplings. *GEC-370*
Joslyn Mfg. & Supply Co.

33. Temperature ratings

Tempil Corp. has a revised catalog including new temperature ratings of products developed in 1959. It lists the 80 temperature ratings of Tempilstiks and of Tempilaq



New design features increase flexibility of Berry Hydraulic Fan Drives

ELIMINATE BELT, SHEAVES AND GEAR BOXES

- Both pumps and motors offered with 21 standard internal gear ratios. Pumps now directly connected at prime mover speeds from 250 to 1750 RPM. Motors now directly connected to fans, water pumps, etc., operating from 100 to 2000 RPM.
- Fans may be directly mounted on the shafts of gearhead units.
- New bearing configuration . . . incorporated to give virtually unlimited operating life on temperature controlled systems.
- Shouldered shafts to facilitate installation of fans, couplings, etc.
- Right or left hand manifolding for ease of piping.

Berry Hydraulic Fan Drive systems are now in use by more companies than any other make . . . installed in attended and unattended main line stations, booster stations, field compressor stations, as well as in gasoline plants and refineries. Mail coupon today for more information on Berry Fan Drives.

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record-breaking tunnel job *fully protected*

For lifelong dependability in a vital power generating installation, these 13-foot diameter penstocks were lined, coated and wrapped by Hill-Hubbell corrosion protection experts.

Whether yours is a large or small diameter installation, the best possible protection you can specify is Hill-Hubbell, the name synonymous with quality in mill coated-and-wrapped pipe.

Specify Hill-Hubbell wrapped pipe on your next job . . .

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the Concentrated fuel

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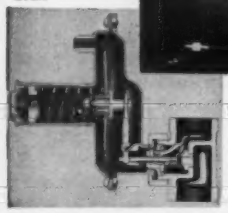
A REGULATOR, BREATHER VENT AND CATHODIC INSULATOR IN ONE PACKAGED UNIT



U. S. Patent No. 2,577,480. Other Patents Pending.

TYPE 51-R FOR EVERY INSTALLATION

EXCLUSIVE FEATURES NOT FOUND ELSEWHERE!

Exceptionally high relieving capacity obtained by new type internal relief valve. Remarkable by-pass check valve prevents over-shooting of low pressure and damage to meter.

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CONTROLS CORPORATION
P. O. BOX 13122 WALNUT HILL STA.
DALLAS 20, TEXAS

covering the range from 113 to 2500 deg F in systematically spaced intervals. *GEC-540*
Tempil Corp.

34. Corrosion probe

A new corrosion measurement probe checks electrical resistance. Its main use is measuring hard-to-detect liquid and gaseous contaminents. Crest's probe detects the slightest change in humidity, ozone concentration, water content in non-aqueous liquid, or other environmental conditions that attack metal. *GEC-110*
Crest Instrument Division

35. Leak repair

Adams Pipe Saver clamps, designed for repairing small leaks and splits in pipe, are covered in a new bulletin. While designed primarily for steel pipe, the clamps are said to be ideal for use on plastics pipe. Even distribution during tightening and smooth functioning of clamp eliminate danger of crushing plastics pipe. *GEC-340*
Adams Pipe Repair Products

36. Outdoor signs

Arkla has published a bulletin on its Gasigns, another load-builder. The outdoor signs are illuminated by six gas mantles, mounted within the sign housing. They furnish 300-360 candlepower illumination. *GEC-550*
Arkla Air Conditioning

37. Water softening

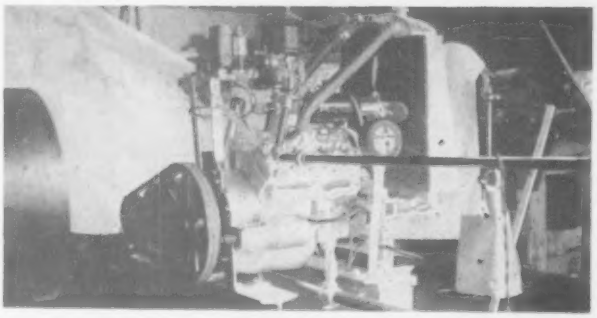
A manual (No. 4520) on sodium zeolite water softening has been issued by Cochrane Corp. The booklet, "Sodium Zeolite Softeners," describes the process and gives information on selecting and sizing equipment. Automatic vs. manual controls and calculations of softening capacity are discussed. *GEC-850*
Cochrane Corp.

38. Conversion burner

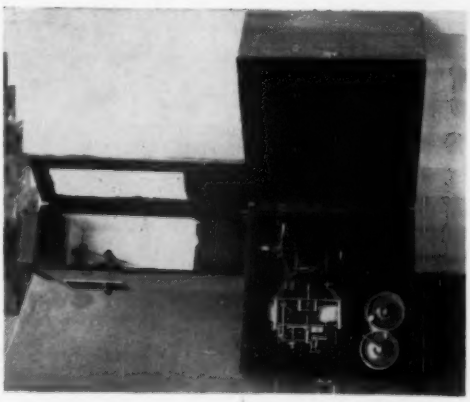
The inshot Tele-Tube gas conversion burner produced by Barber Manufacturing Co. is discussed in a new catalog. Described is the burner's adjustable venturi, which telescopes from 6½ in. to 13½ in. to fit 95 per cent of all existing furnace and boiler installations. *GEC-060*
Barber Manufacturing Co.

GAS

PIPELINE SECTION



A history of CATHODIC PROTECTION



NATIONAL'S Revolutionary MANI-FLO® VALVE

PATENT APPLIED FOR

The MANI-FLO valve, through unique design, lends itself to wide use in the production of oil and gas. Designed primarily for use in lease well production manifolds to eliminate the problems and expenses of conventional arrangements consisting of cumbersome piping, standard valves and fittings, it may also be used as a three-way valve for blending two streams for temperature control; for mixing two different liquids or gases; or as a switching valve to divert flow to different tanks or lines.

In any role or application, MANI-FLO valves may be hydraulically, electrically or diaphragm controlled and sensed by liquid levels, pressures, temperatures, times or differentials of these.

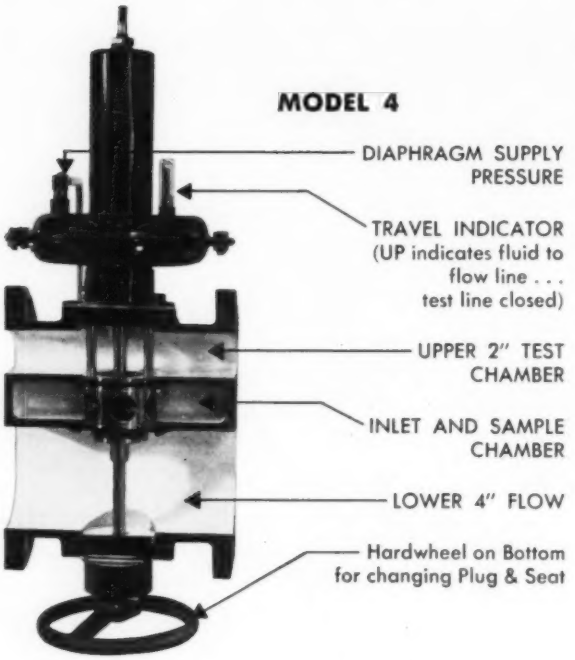
MANI-FLO valves may be installed in a horizontal line with diaphragms and/or handwheels either vertically or horizontally, or valves may be stacked vertically from ground up with controls pointing in any direction.

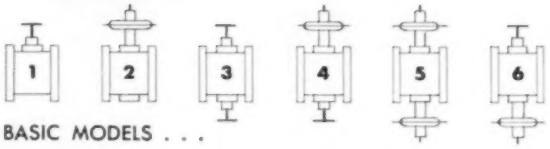
TYPICAL SPECIFICATIONS:

SIZE: 2" screwed inlet — 2" test outlet — 4" flow outlet — ½" sample connection opposite 2" inlet.

WORKING PRESSURE: 600 PSI. Test Pressure 1200 PSI.

MATERIAL: Body and Body Cover Flanges — Ductile Iron. Diaphragm Case — Pressed Steel. Plug, Seat and Cage — Type 303 Stainless Steel. Plug has Buna N synthetic rubber molded to 303 to give same sealing characteristics as "O" ring for tight shut-off. Metal-to-metal contact between plug and seat to prevent extrusion of rubber and to take excess force applied to seat and plug when closed.

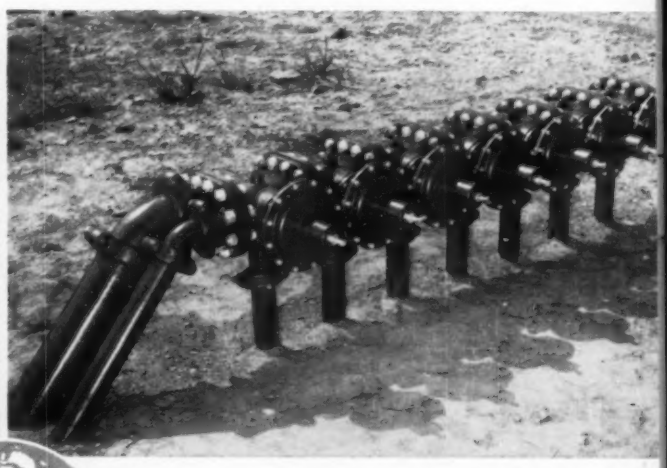

MODEL 4
DIAPHRAGM SUPPLY PRESSURE
TRAVEL INDICATOR (UP indicates fluid to flow line . . . test line closed)
UPPER 2" TEST CHAMBER
INLET AND SAMPLE CHAMBER
LOWER 4" FLOW
Hardwheel on Bottom for changing Plug & Seat



BASIC MODELS . . .

FACTS:

- COMPACT . . . less space required for complete manifolds
- EXPANSIBLE . . . add a well — add a MANI-FLO
- VERSATILE . . . for line pressures 600 PSI or less:
  a. May be used as a shut-in valve
  b. Six different models for various applications to choose from
- PRACTICAL . . . travel indicator or positive flag
- SALVABLE . . . bolt it in or un-bolt it
- LONG-LASTING SAFETY . . . ductile iron bodies with stainless trim, tested to 3,000 PSI
- ACCEPTED AND APPROVED . . . hundreds in use already
- LOOKS THE PART . . . Judge for Yourself!



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CORROSION PREVENTION

Here is a history of cathodic protection development as experienced by Montana Power Co. from 1934 to 1958. It is of interest because many methods pioneered by Montana Power are being used today.

A history of cathodic protection

By C. R. DAVIS, Assistant Manager, Engineering Department
Montana Power Co., Butte

MONTANA POWER CO. was one of the first companies to place a gas transmission line over 275 miles long under complete cathodic protection. We also designed and installed cathodic protection for distribution systems before many others. Our gas system crosses the Continental Divide, traverses areas of variable soil conditions and is exposed to 3300-v and 2500-v d-c electric railways systems. An account of how we solve our problems may be of some help to other companies faced with similar conditions.

Montana Power's gas transmission system consists of over 1000 miles of 6-, 8-, 10-, 12-, and 20-in. steel pipe, mostly coated. This pipeline net serves over 70 city, town, and community distribution systems scattered over a wide area in western Montana.

The west transmission system, 188 miles of 20-in., 16 miles of 16-in., 8 miles of 12-in., and 14-miles of 10-in., started at our Cut Bank gas field in northern Montana and extended to Butte and Anaconda. The east transmission system had 115 miles of 10-in., extending from Dry Creek field, in the south central part of the state, to Bozeman, Mont. These lines together with their distribution systems, were installed during 1931.

During 1951, an 82-mile 10-in. tie was installed between Bozeman and Butte, tying the east and west systems together. In 1954 we purchased transmission and distribution systems from Montana-Dakota Utilities Co. which extended our holdings to east of Havre, Mont. In 1956 a tap from our 20-in. line was installed to Missoula and Hamilton, Mont. In 1957 a line was built from Big Coulee field to Lewistown. Our gas system is shown in *Fig. 1*.

The soil in which the lines are laid varies from dry and sandy, to alkali and marshy. Part of the transmission lines and some of the distribution systems are exposed to stray current from 3300-v d-c and 2500-v d-c electric railway system. During the time of, and for some time after, installation of the Butte distribution system it was also exposed to a 500-v street railway system. This street railway system has since been discontinued.

When the Montana Power Co. gas lines were installed, a soil and electrolysis survey was made by engineers experienced in this type of work. They recommended that electrolysis should be controlled by insulation—an approved method then. These recommendations were followed during construction.

About three years after completion of construction, it was found from inspection that some of the transmission lines were quite badly pitted. This was due to galvanic action at imperfections or "holidays" in the coatings. One of the minor tap lines developed leaks due to galvanic action where an inferior type of coating had been used. Electrolysis had also badly pitted the pipe in Butte and Deer Lodge distribution systems at holidays in the coatings.

In 1935, some protective work was done on a leak-

ing tap line by using zinc anodes. This method was effective, but expensive and unsuited for a general protective program at that time. We now use a considerable number of galvanic anodes—zinc and magnesium—to augment our rectifiers at points where potential is low and we need added protection to complete our program.

In 1936, Starr Thayer, corrosion engineer for United Gas Corp. (Houston), was engaged to make a survey of the Montana Power Co. system. Thayer recommended that: (1) all Dresser type couplings be bonded, (2) drains to railways be installed, and (3) cathodic protection be placed on our transmission lines. His recommendations were acted upon. But we went further than his recommendations and decided that if cathodic protection was good for transmission lines it would also be good for distribution systems. So we proceeded to enter this field also.

All of our transmission lines and at least 95 per cent of our distribution lines are now under complete cathodic protection.

The first step in our protective program was to make a complete survey of pipe-to-ground potential. On the first survey a 1-million-ohms-per-volt voltmeter was used with a copper sulfate electrode. However, it was found that soil resistance was so high a 500,000-ohm-per-volt voltmeter and steel electrode gave excellent results for instantaneous readings. From the potential survey it was possible to tell which spots on the lines needed attention first. Bonding crews were started in these sections. All compression couplings on the transmission and distribution systems were then systematically bonded. During the survey, possible groundbed locations and power sources were noted. Information was also obtained from the weather bureau on wind conditions along the line.

The resistances of possible groundbed locations were measured with a ground ohmer. A standard electrode for resistance test was used. It consisted of a 2-in. piece of galvanized pipe driven 4 ft into the ground. By comparing a number of earth resistances with actual groundbed resistances, after installation, it was determined that final groundbed resistance

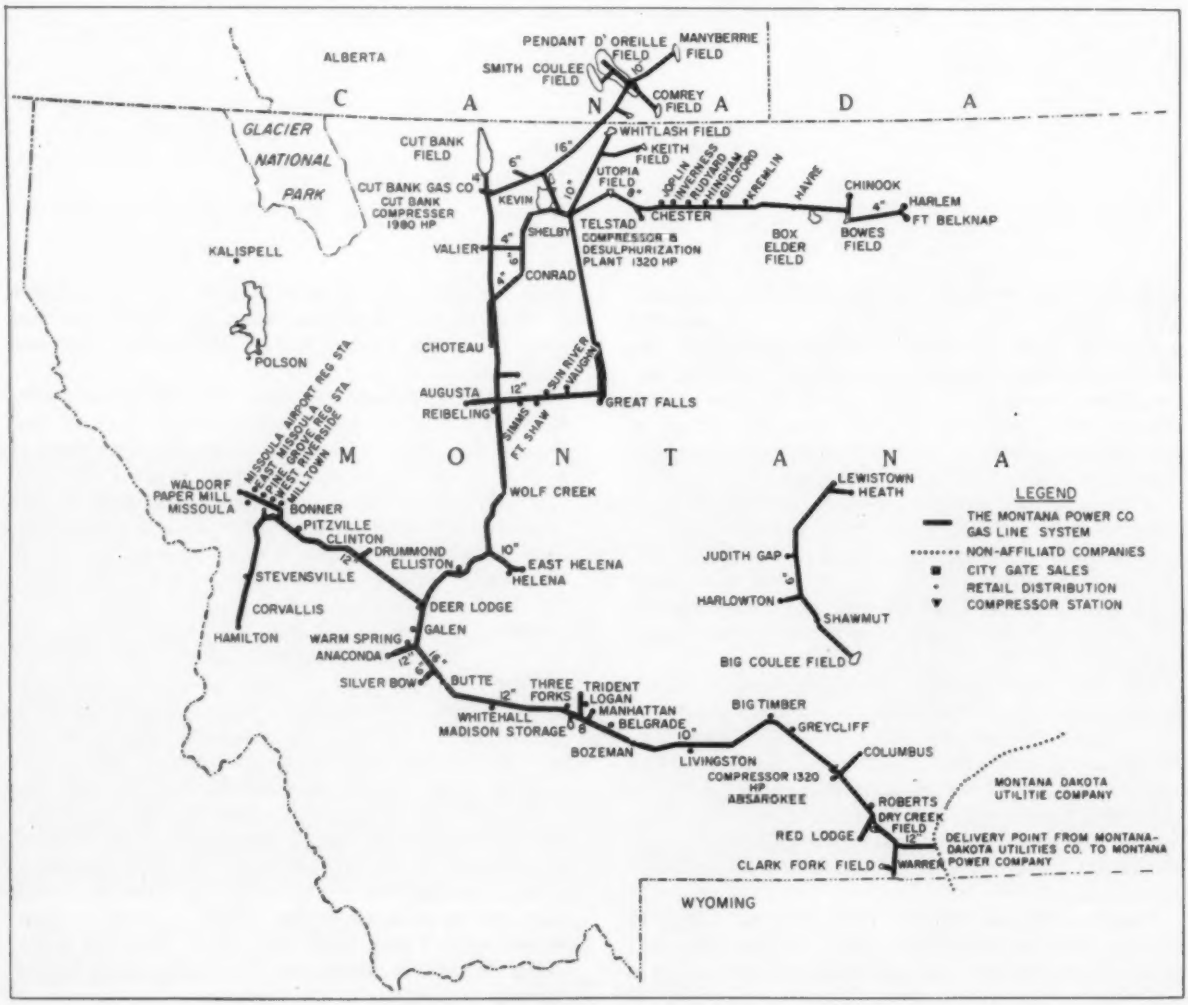


Fig. 1. Montana Power's gas system.

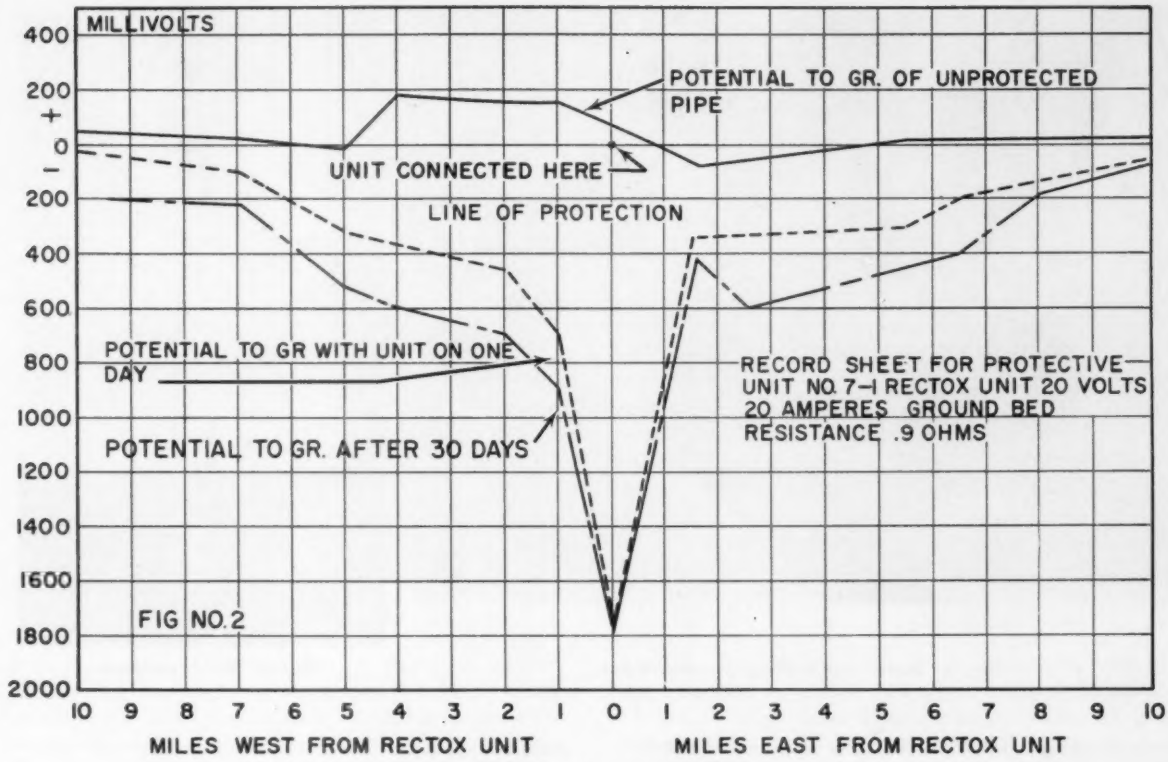


Fig. 2. Coverage of first rectifier installation.

would be approximately 0.10 of the reading from a ground ohmer with this standard electrode.

The first rectifier installation was made on the 10-in. transmission line in the spring of 1937. This was a 20-v, 20-amp unit connected to a groundbed consisting of twenty-nine 10-in. pieces of standard weight pipe driven into the ground 10 ft and spaced 20 ft apart. The groundbed had a resistance of 0.60 ohm. Coverage of this unit is shown in *Fig. 2*.

Based on the results of this first unit, groundbed locations were laid out at intervals of approximately 10 miles along the 10-in. line between Dry Creek and Bozeman. It was found that most of the locations were near enough to a-c electric lines to use rectifiers. However, at six locations some other source of direct current had to be supplied. Prevailing wind data showed suitable conditions for wind generators at three locations. Gas-engine generated power was used on the remaining three sites. A description of the different types of groundbeds used will be given later.

The worst pitting occurred on the 10-in. transmission line because it has an asphalt base coating that was not impervious to water. This line was placed under protection first. Subsequently, hot spots on the 20-in. transmission lines were protected. By the end of 1940, 90 per cent of the entire transmission system and 80 per cent of the distribution system were under cathodic protection. Storage tanks, gathering lines, well casings and other underground equipment of the producing company were also protected.

The rectifier units were built up by our shop from parts purchased from Westinghouse Manufacturing Co. Standard 20.5-v, 1.26-full wave rectox stacks and 1650-v-amp transformers were purchased. The unit for each groundbed was designed by paralleling the correct amount of stacks to give desired amperes. If more than 20.5 v were needed, two or more units were connected in series. The rectox units have given trouble-free service. Some units have been in continuous service for 25 years. *Fig. 3* shows one of the rectox units as we built them.

During the first two years of electrolysis work, three different makes of wind generators were tried. It was found that the Jacobson wind generator was far superior to the two other types tried. This make was adopted as standard equipment. This unit is shown in *Fig. 4*.

An endeavor was made to pick locations where weather bureau records indicated sufficient wind to put current into the line at least 50 per cent of the time over a 10-year period. This required a 5-mph wind, or greater, 60 per cent of the year. After wind generators were installed the input was checked with a recording ammeter for a period of six months. It was found that in most installations current was being generated in large enough amounts to reverse the positive areas for at least 75 per cent of the time.

To check the effect to polarization on pipe protection in connection with the wind generators, a photographic recording voltmeter (shown in *Fig. 5*) was developed.

This recorder consists of a spring-driven movement

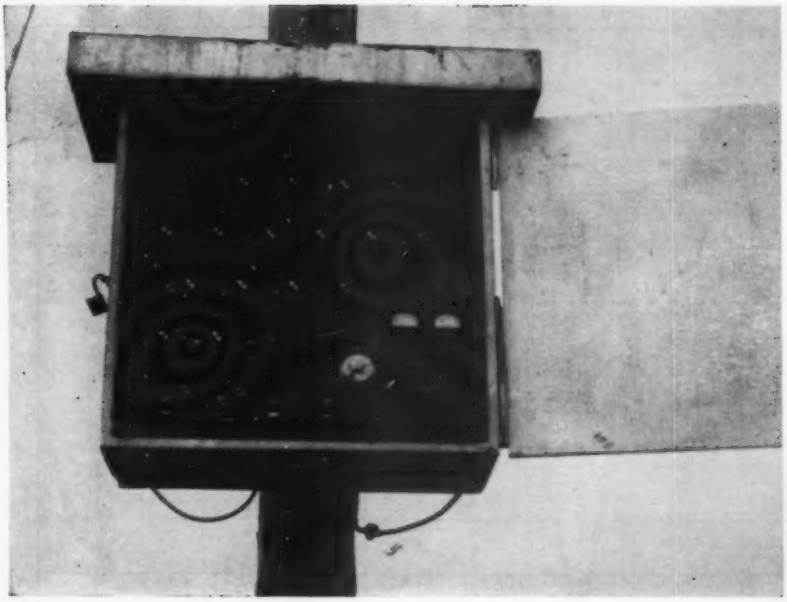


Fig. 3. Rectox unit built by Montana Power.

Fig. 4. Wind generator.

for advancing a 16-mm movie film at a uniform speed of exactly one frame each 15 min. The clock movement also actuates two switches. One switch controls the light source for exposing the film and the other the voltmeter element.

The photographic element consists of a lens focused on the dial of a high resistance (50,000-ohms-per-volt) galvanometer. No shutter was used as the lens and galvanometer were enclosed in a light-tight compartment. Exposure time was controlled by the period the light was on. To eliminate polarization of ground electrodes as much as possible, the galvanometer was connected to ground electrode and the pipe only during time the film was being exposed. To accomplish this, the clock actuates a mercury switch connecting the galvanometer in circuit 30 sec before exposure, which allows the meter to come to rest, and remains in circuit 30 sec after exposure. The light source, which consists of a 32-candlepower automobile headlight bulb fed by two dry cells, is flashed by the clock actuating a mercury switch at the exact time the frame on the film is in place. This clock operates 30 days on one winding and a 50-ft roll of film lasts 21 days, taking one exposure each 15 min.

Observations made with the photographic recorder and a recording ammeter on one wind generator showed that over a two-month period polarization aided in retaining the potential of the pipe so that at least 0.15 v negative to soil was maintained during the entire period. The ammeter indicated that the generator was putting current into the line 57 per cent of the time during this period. The longest period during which no current was going into the line was 20 hr. However, several of these 20-hr periods occurred during the test period. Before protection was put on this line, which is a 20-in. line with excellent coating, potential to ground was 0.20-v positive.

Another test wherein it was possible to vary the current input (which was run with the same instruments) on a 20-in. pipe in similar soil but protected only with a primer coat, showed that it required 90 hr for the line to become completely depolarized from its highest potential obtained from a fixed current which had been on the line for two weeks. The results of this test are shown in *Fig. 6*. These tests indicate that the better the coating on a pipe, the longer the effect of polarization will last.

On bare pipe in low resistance soil, the effect of polarization would be very small. Polarization on a fairly well coated line will raise the effectiveness of a wind generator at least 20 per cent. A good wind generator is a cheap, trouble-free source of direct current where the wind is steady enough to cause generation of current at least 60 per cent of the time and the pipe is very well coated. *Fig. 6* also shows the effect of polarization on well coated pipe.

At the time the Montana Power Co. started its cathodic protection program, gas engines designed for cathodic protection units were not available. Thus, considerable experimental work was done developing a unit using standard gasoline engines for power source. The first tried was a single-cylinder 7.5-hp air-cooled engine with a natural gas carburetor, extra oil reservoir and protective devices as furnished by the manufacturer. This engine was belted to a flat compound-wound, 32-v, 1.50-kw d-c generator. The engine ran at 1200 rpm. This type of engine was found to be very unsatisfactory due to over heating, warping of valves and carbon deposition, causing knocking and freezing of rings.

We built a unit using a Ford V-8 60-hp engine as

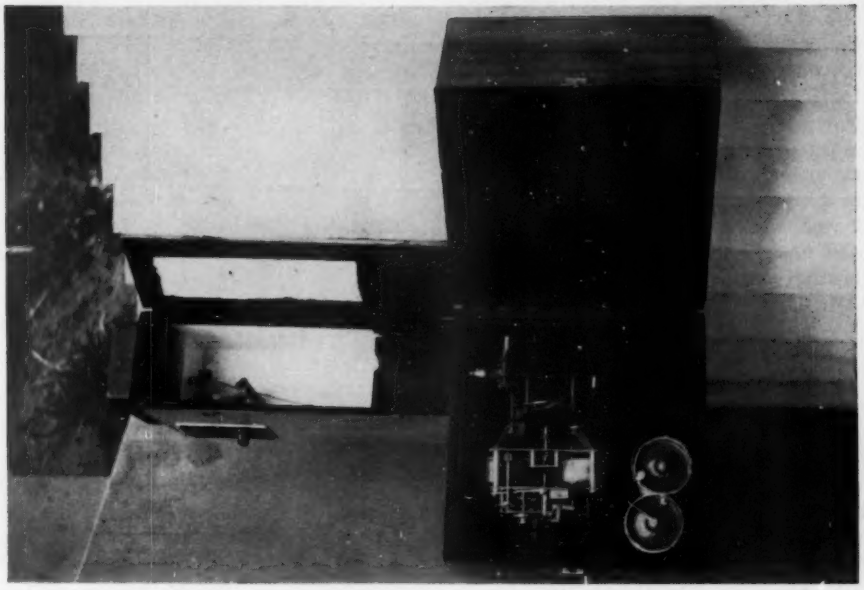


Fig. 5. Photographic recording voltmeter developed to check effect of polarization on pipe protection.

a power source. The assembly is shown in *Fig. 7*. The engine was belted to the same type of generator used for the air-cooled engine. Running speeds were held under 1000 rpm to reduce wear on engine parts. The engine was protected by high temperature and low pressure oil cutouts. Considerable trouble was experienced at first with carbon building on the piston heads and sticking rings. This trouble was traced to the type of oil used.

It was learned that all carbon trouble could be eliminated by using a diesel-engine lubricating oil. Socony-Vacuum DTE medium seems to give the best results. One of these units ran 28 months averaging over 732 hr per month for a total of 20,000 hr of operation without major repairs. The oil consumption of the V-8 units averaged about 6 qt a month. The gas consumption was approximately 32 Mcf a month. Six of these Ford V-8 units were used at one time on our system.

Two direct-connected gas engine generators were used at one time. One was a 64-v U. S. plant, 4-cyl water-cooled engine and the other was a single-cylinder, water-cooled, Jacob's, special cathodic protection unit. Both of these units gave good service, but it

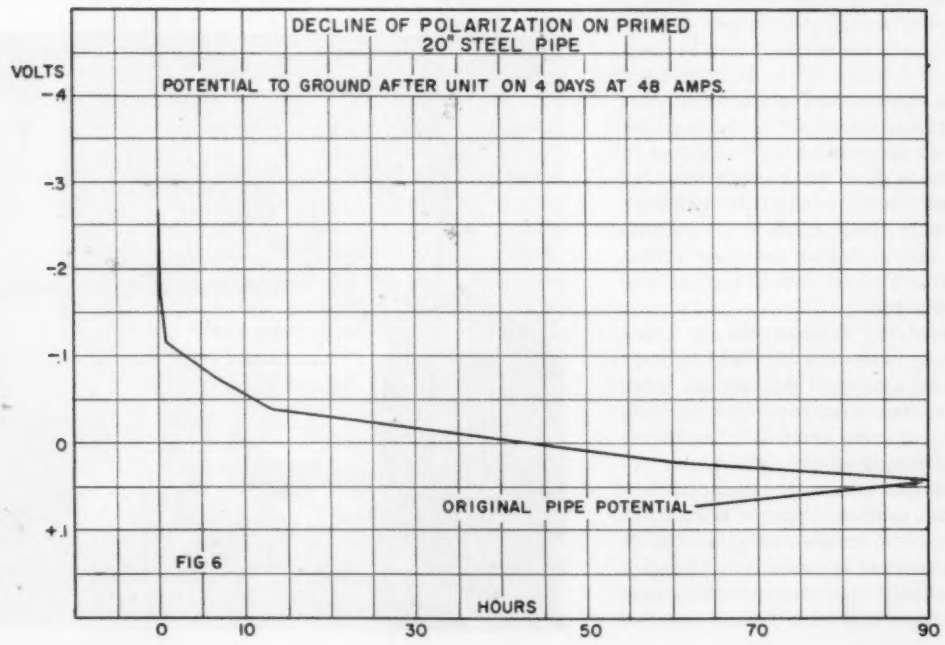


Fig. 6. Decline of polarization on primed 20-in. steel pipe.

is the writer's conclusion that the Jacob's engine is the answer to a corrosion engineer's quest for a gas-driven generator. This machine is especially designed for the job on which it is to be used. It is a sturdy slow speed engine with very few moving parts.

During the last 25 years Montana Power Co. has experimented with many types of groundbeds. We first used scrap pipe for anodes. With the help of formulas and data published by James G. Biddle Co., and much experimenting, we came up with the following conclusions:

1. That the groundbed for cathodic protection units in our locality should be located between 400 and 600 ft from the transmission line it is to protect.
2. That wherever the soil is deep enough vertical driven anodes or anodes installed in drilled holes should be used.

The length of these vertical anodes will vary from 8 to 30 ft, depending on the depth of low resistance soil. Spacing between anodes will vary from 10 to 20 ft or even up to 50 ft, depending on the length of low resistance ground available. Heavy railroad rails are preferred for anodes.

The first groundbeds were tied together by rubber-covered copper cable with heavily tarred joints. Replacement costs were excessive due to the difficulty of maintaining insulation on the wire. Wherever a small fault occurred in the insulation, wire disintegrated in a short time causing an open circuit.

Present practice on driven groundbeds consists of tying the anodes together with boiler tube above ground. If the header must be buried because of right-of-way restrictions, heavier material, such as light railroad rails, is used for the tie. Because of the availability of large quantity of heavy railroad rail, we have used this almost entirely for our groundbeds. After this rail has been used up we will probably use carbon anodes for our groundbeds.

Where driven groundbeds are impractical because of shallow soil depth, horizontal groundbeds are installed using heavy railroad rail buried 4 to 6 ft deep. This rail is buried in a trench 500 to 1000 ft long, depending upon soil resistance and availability of a suitable length of ground. The rail is laid in the bottom of the trench and covered with about a foot of soil. A 4-in. drain tile is laid horizontally the full length of the bed, about 1 ft above the rail, with both ends of the tile brought to the surface. This permits the bed to be flooded and salted as the need arises. We use about 3 lb of stock salt per 100 ft of rail to lower resistance of the bed.

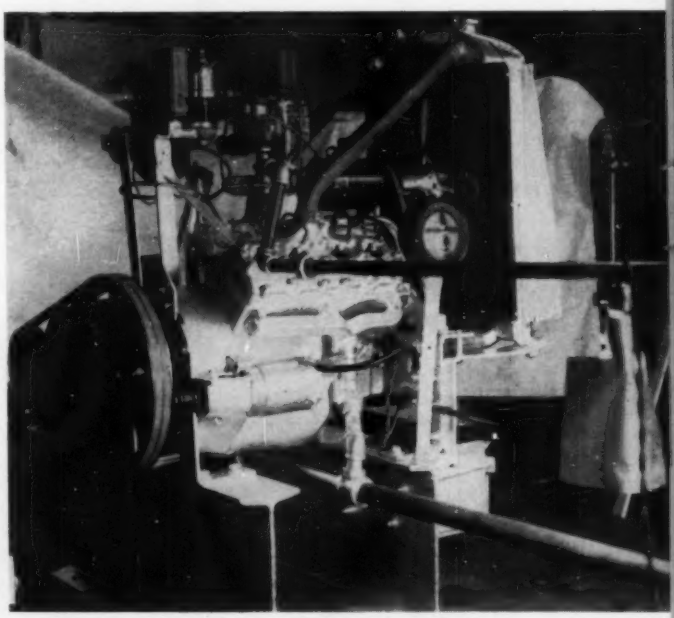
In two of our distribution systems we are using abandoned street railway rails for our groundbeds. We also use abandoned artificial gas mains, after isolating them from all other structures, for groundbeds in some of our distribution systems. To observe the effect of an extremely deep groundbed, we are using a bed to protect the center of the Butte distribution system which is unique in that it is installed in an abandoned drift of a manganese mine 300 ft below the network of pipe that is protected. This bed consists of 7 tons of railroad rails covered with about a foot of solid waste mine material. While the bed has a high resistance, the unit connected to it completely protects an area approximately eight blocks square on the gas distribution system, together with all piping in the mine and several blocks of telegraph cable.

Our standard practice on distribution system, now, is to install a distributed groundbed wherever we have power poles available. We install a rail at the foot of each power pole in the alley over the entire area to be protected. This rail is tied to an overhead tie wire, making a solid grid. A rectifier is connected through this grid into the gas line wherever we find it necessary to bring the potential up to protection. We are able to keep the voltage of rectifiers low. We have less loss due to over protection by using this type of groundbed than any other that we have yet tried.

The first electrolysis leaks on our distribution system appeared in Deer Lodge in 1937. This distribution system is divided by a river carrying waste from a smelter and paralleled by a 3300-v d-c railway. Much of the ground is saturated with salts from the river water and carries considerable stray current from the electric railway. These stray currents are picked up by the gas system. Even though mains in this system were broken up by insulating joints and protected by an asphalt coating, extensive pitting occurred. This condition was further aggravated by the city water company making a solid bond to our system on the advice of persons unknown to us (but certainly misinformed as to the effect of such a tie). The water company was also solidly bonded to the d-c railway rail.

Petroleum asphalt coating used on this job did not adhere to the pipe very well. It absorbed moisture to the extent that it became a conductor. The pipe was

Fig. 7. Montana Power-built engine for cathodic protection units.



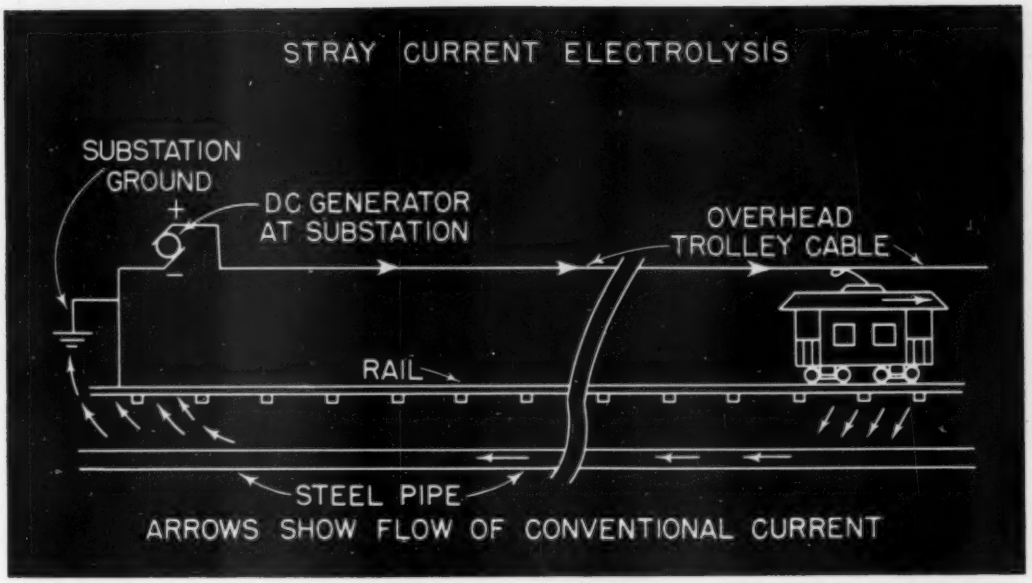


Fig. 8. Stray current electrolysis.

severely pitted on each side of insulating joints, showing that current was leaving the pipe through the soil and returning to the pipe beyond this compression-coupled joint. The current was also reversing direction, depending on the location of trains with respect to the bond between the water mains, gas mains and railroad substation situated several miles on either side of the towns. The action taking place is shown on *Fig. 8*.

Further investigation indicated soil corrosion was also causing pitting on this distribution system. In view of the fact that soil corrosion was active, and because we could not purchase a suitable directional relay to control the d-c current flowing to our system, we decided to install forced drains on this system rather than establish directional drains to the railway.

After the pipe-to-soil survey was completed, the system was entirely insulated from the water system. This involved removing all bonds and installing formica bushings on the low pressure side of the house regulator. All insulated joints and compression couplings were then bonded. After this work was completed, two groundbeds of scrapped railroad rails, buried about 4 ft deep in trenches, were installed. A 20-v, 20-amp rectifier was installed on one bed and a 40-v and 15-amp rectifier was installed on the other. It was found by test that 16 amp from these two rectifiers maintained the potential of the gas lines at 0.30 of a volt negative to the surrounding soil at all times. Sufficient connection to the water mains was established through controlled resistance to keep the water main from becoming damaged by our protective current. This installation has been very successful.

Only two leaks have occurred on this system since the protection was applied. These were in a section that fell below adequate protective potential due to allowing current to drop because of aging groundbeds. We now have a system of reports established which gives us the records of voltage and current on every rectifier on our system. This enables us to keep current at the required value by proper maintenance of units. We have not replaced any mains on this distribution system since insulation and cathodic protection.

Deer Lodge is a small distribution system containing only 14 miles of 3-in. equivalent mains. It is a typical cathodic protection installation. The procedure used in this installation was followed throughout our distribution systems. However, special features were added in some of our installations which are of interest and will be described.

The Butte distribution system contains 194 miles of 3-in. equivalent main. This system is installed largely on decomposed granite which ordinarily isn't considered corrosive. But Butte is a mining town. There are hundreds of mine dumps, all of which carry salts such as copper sulfate, iron oxide and many others which leach out and contaminate the soil, causing it to be highly corrosive in spots. The Butte distribution system is also exposed to 3300- and 2500-v d-c railway systems. When protection was first started on this system, a 500-v d-c railway system was also in operation. Dressers were installed in the system approximately every 160 ft and asphalt coating was used.

Five years after the Butte system was completed, leaks began to appear. Investigation showed extensive pitting on each side of the Dressers. Also, at other spots on the main and services we found pitting where the coating was damaged or had deteriorated. A program of bonding and insulating from the water system was started at once.

A directional relay was developed and installed between the Butte gas mains and the negative return of the 500-v street railway, and also between the 3300-v and 2500-v d-c railways' negative returns.

These relays closed the circuit to the negative return whenever potential difference between the gas mains and negative return exceeded 0.20 v, with the

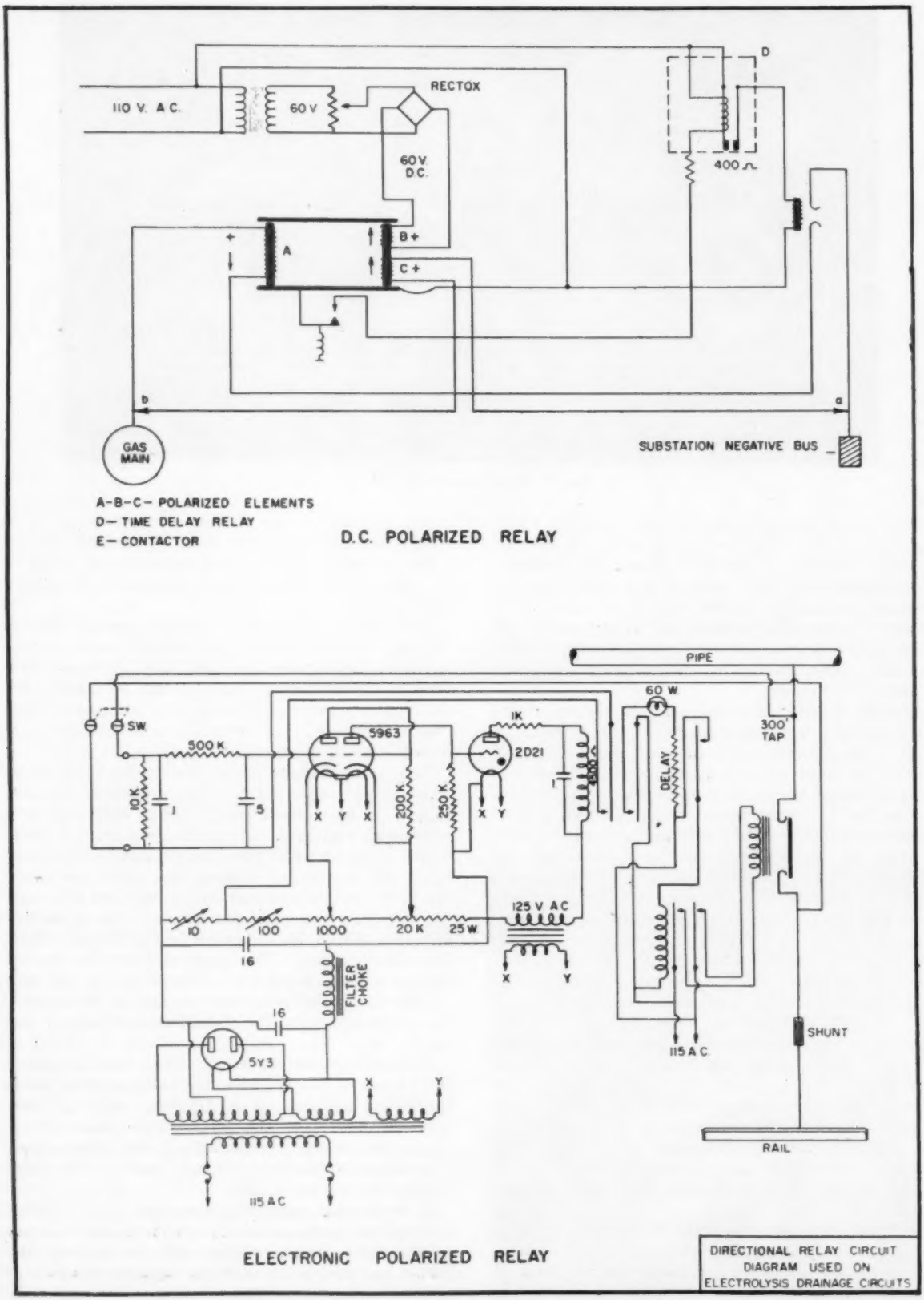


Fig. 9. Directional relay circuit.

Fig. 10. Current and potential records with directional relay open and closed.

gas main positive. It opened whenever the current reversed, flowing towards the gas main. The circuit diagrams are shown in *Fig. 9*. A description of these directional relays was published in May 1939 issue of GAS. The circuit, based on a Westinghouse Type HI relay, has not been changed, but the electronic circuit has been improved since publication. A potential-to-ground chart is shown for the relay return, closed and opened, in *Fig. 10*. Currents as high as 2200 amp were not uncommon in return for the 2500-v system and 500 to 1000 in the 500-v street railway system.

After bonding couplings and insulating gas lines from the water mains, directional relays held the system reasonably negative to surrounding soil by the stray current drained. Most protection came from the 500-v d-c railway because of its widespread coverage of the city with street railway tracks. The street railway was discontinued in 1937. Immediately, our gas system became positive in most areas. It was necessary for us to install a source of d-c to replace street railway current.

We purchased the street railway tracks serving the center of the city and used them as groundbeds. We connected rectifiers to these tracks wherever needed to give system protection. In addition to track groundbeds, we installed 17 others. Most of these were railroad rails installed in 33-ft, vertically drilled holes.

The 20 units in our Butte system have a combined output of 327 amp. These, with the drainage current

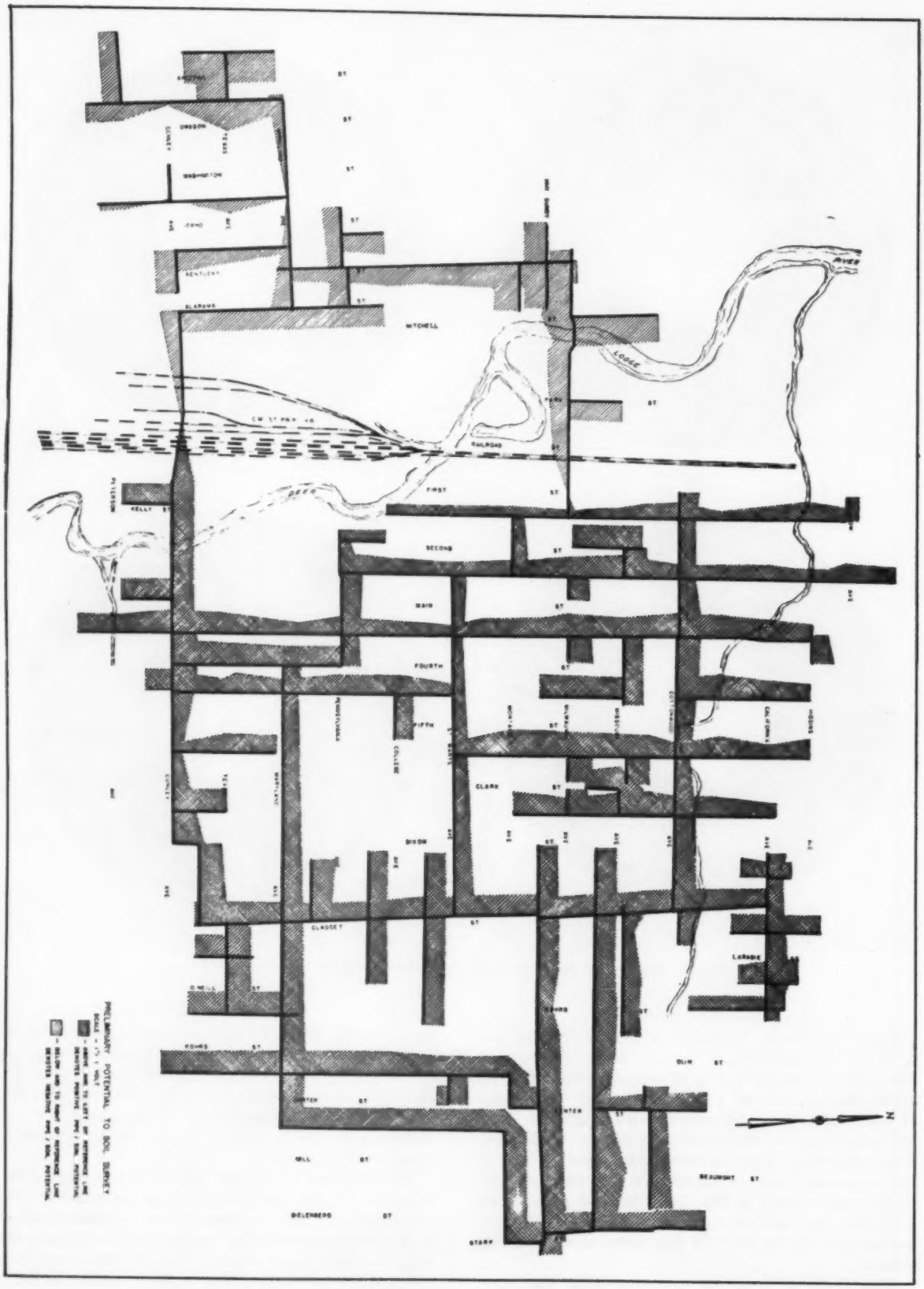


Fig. 11. Example of pipe potential records.

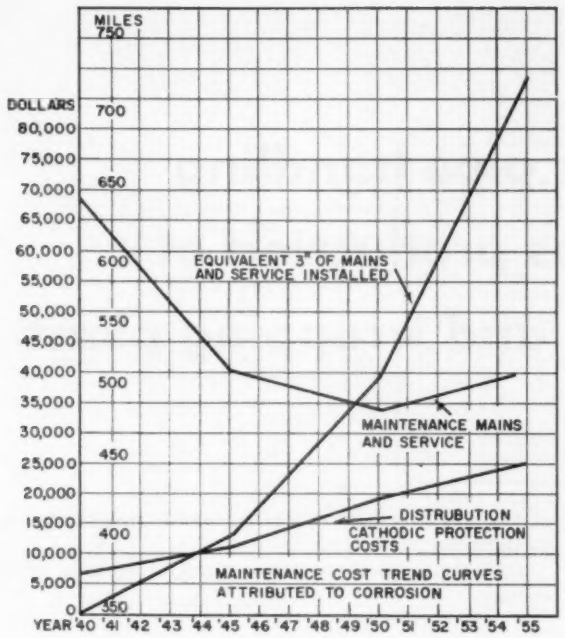

MILES
DOLLARS
EQUIVALENT 3" OF MAINS AND SERVICE INSTALLED
MAINTENANCE MAINS AND SERVICE
DISTRUBUTION CATHODIC PROTECTION COSTS
MAINTENANCE COST TREND CURVES ATTRIBUTED TO CORROSION
YEAR '40 '41 '42 '43 '44 '45 '46 '47 '48 '49 '50 '51 '52 '53 '54 '55

Fig. 12. Maintenance curves.

of d-c railways, protect about 97 per cent of the entire system.

Examples of pipe potential records for transmission and distribution systems are shown in *Figs. 2 and 11*. Potential observations on all lines are taken at least once a year. On the transmission lines, test leads are installed each half mile and readings are taken at these spots. Where pipe is under paving in the distribution system, readings are taken by contacting valves or on services.

Our 1957 potential-to-ground survey showed us that in many places our transmission lines were becoming positive to soil. This was brought about by deterioration of groundbeds and bonds opening. We decided to initiate an extensive maintenance program to repair all bonds and groundbeds to restore their original output on our entire system.

One section of our 20-in. line had bonds soldered on across Dressers by using Pal-weld and ordinary solder with an acetylene torch. After 20 years, many of these bonds opened because not enough heat was used to entirely dissolve the Pal-weld during the soldering process. This allowed ingredients in the Pal-weld to amalgamate the solder and destroy strength of the solder joint. The bond came loose, opening the circuit for our protective current.

During 1958 we initiated a program to replace all soldered bonds with electrically welded bonds. During this rebonding operation, we also repaired all our groundbeds and brought them up to full output. This brought the line back to full protection again.

During 1958 we also started an electrolysis school for our maintenance men with the idea that if we acquainted them with what corrosion could do to pipelines, we would be able to get a better job of maintenance. At this school we covered all phases of corrosion and electrolysis. We also taught the men how to read instruments and apply different pipe wrapping. We believe this school is paying off. We are now getting many more readings on our transmission lines without increasing our labor force. We believe we have stimulated interest in corrosion among maintenance men to a point where they will see that systems are under protection at all times.

Because of the progressiveness of our gas operating engineers and management at Montana Power, we were able to start a protection program on our distribution system long before cathodic protection of distribution or transmission systems was common practice. We started a protection program before our systems had been badly damaged. Therefore, we were able to hold our replacements of mains and transmission lines to almost zero and our leak record to a very low figure. This is shown by maintenance curves in *Fig. 12*.

Due to the relative lack of moisture in our soils, and because most of our protective program had been completed before anodes were available in large quantities, we have used very few anodes on our distribution systems. We do feel they have a very definite place in a protection program.

We have found that one of the first steps necessary to set up a cathodic protection program for any system is to consult other utilities with underground structures—telephone, telegraph, power and water companies—which might be affected by such a program. If possible, a joint committee consisting of qualified engineers from each company affected, should be set up. If this is accomplished, information can be exchanged which will make all programs more effective.

A summary of Montana Power's experience has shown that the following points are important in the cathodic protection of a distribution or transmission system:

1. It is necessary to have complete supervision by a qualified engineer.
2. It is necessary that the proper instruments be available.
3. The section of a distribution system to be protected must be insulated from other underground systems by insulated joints and bushings, with established controlled points for inter-change of current to prevent damage to other systems. The section must have complete electrical continuity.
4. Readings on output of units must be examined once a month and adjusted if necessary to maintain correct pipe potential to soil for protection.
5. Pipe-to-soil potential surveys should be made at least once a year and plotted on suitable maps for reference. (Red areas are flags for the allied leak detection program.)
6. Proper records of all readings must be kept up to date.
7. It is feasible and profitable to protect large or small distribution and transmission systems if the protection is properly applied.
8. It is feasible to protect bare pipe, but even a coat of primer will greatly reduce cost of cathodic protection. ■

CORROSION PREVENTION

Over a million feet a month

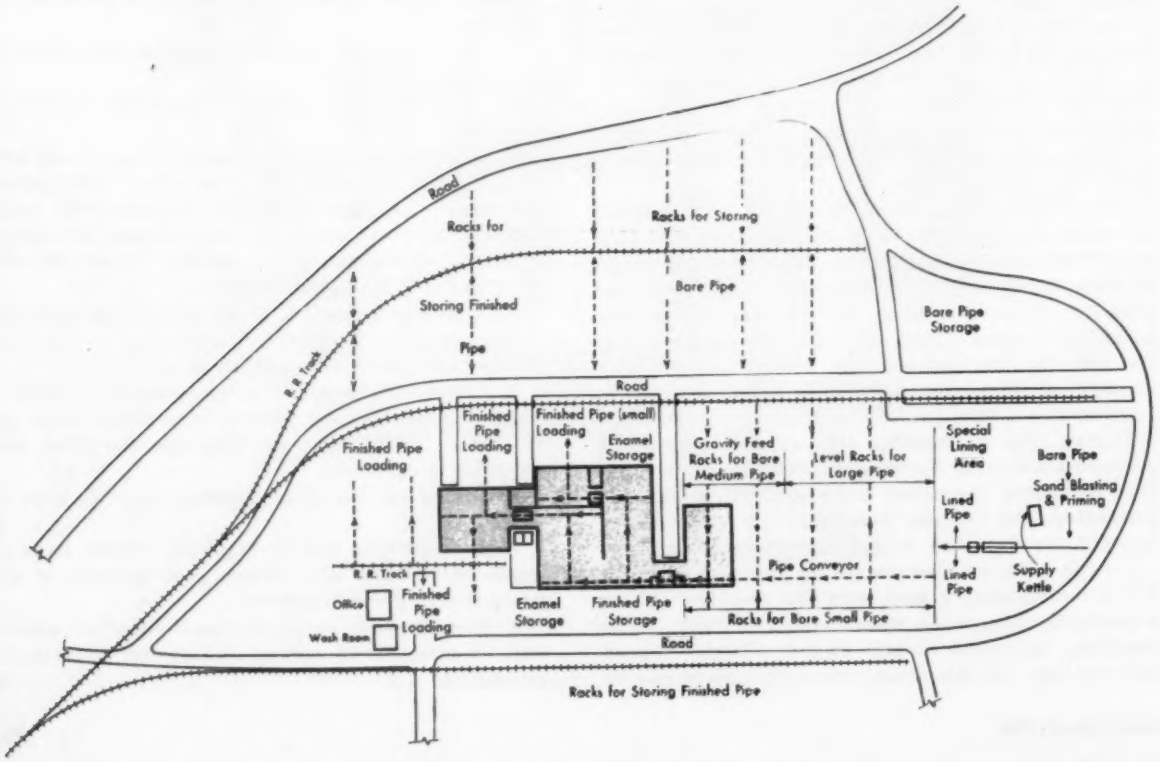
Efficient pipe handling increases production of coating and wrapping plant

SMART pipe handling—from bare storage through processing and loading—is helping boost production and quality control at a pipe coating and wrapping plant in Atlanta. Only four years old, the modern facility has just undergone its third round of expansion and modernization to meet production demands of 45,000 ft of coated and wrapped pipe per 8-hr day. More than a million feet are now processed per month.

Plant features that contribute to high production and quality control are:

1. Large pipe storage areas criss-crossed with roads and railroad tracks for top flexibility in loading and unloading bare and coated pipe.
2. Small railroad transfer cars that move the bulk of small and medium size pipe to and from the plant, minimizing use of large cranes.
3. Storage racks that ease transfer of pipe from storage.
4. Handling devices that automatically transfer pipe from gravity-feed racks to the plant's main conveyor.
5. Three coating lines for greater production flexibility and higher output.
6. Simple, positive coating and wrapping machinery to assure minimum maintenance and top reliability.
7. Special quality-control devices and procedures incorporated in the handling system, such as thermostatically controlled primer heating, padded pipe racks, trucks and tie-downs, closed kettles, ventilated

Detailed plant diagram shows layout of pipe-handling equipment and coating and wrapping machinery.



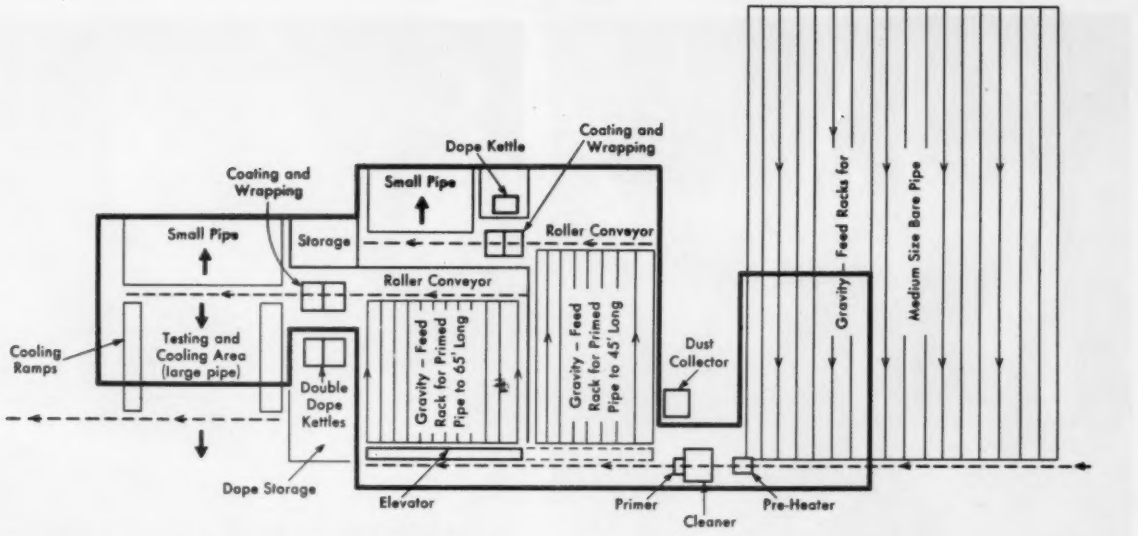
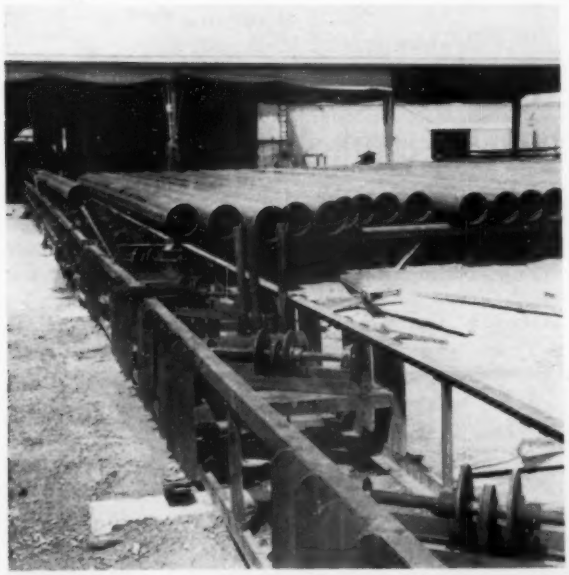


Diagram of storage yard and plant shows how pipe is moved from racks to conveyors and carried through plant. Coated and wrapped pipe can be discharged at three points. Site is criss-crossed with roads and railroad tracks.



Bare pipe on gravity-feed racks is fed automatically on to conveyor. As they move along, pipe joints actuate tripping device. As soon as one joint moves out of the way, trigger actuates a pneumatic device that flips the next joint from rack to conveyor.

buildings, canted supports under pipe ends, and full holiday detection control.

When first built, the plant, a Southern Pipe Coating Co. facility, had basic protective structures and a single coating line limited to 12-in. pipe and smaller. Today the plant roofs the entire production sequence from temporary storage of bare pipe to final cooling and storage of wrapped pipe. There are two semi-automatic production lines—one for pipe up to 60 ft long and 30 in. in diameter, and the other for smaller diameter pipe up to 45 ft long. A third line, outside the plant, can coat and wrap pipe as large as 84 in. It has allied equipment to handle internal pipe lining —with either coal-tar or enamel.

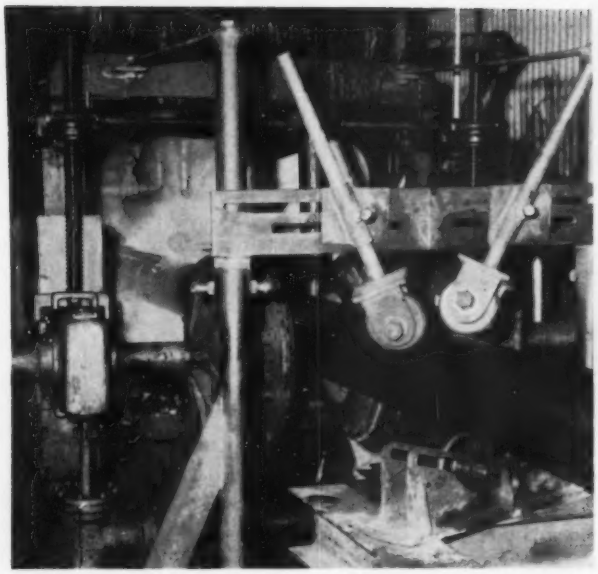
Because of a wide range of pipe sizes, lengths, methods of delivery and processing schedules, one of the basic requirements of SPC's pipe storage system is flexibility. Some pipe comes in and out by rail and some by truck. Certain orders must be pushed through right away. Others have to be stored for long periods and processed as the customer needs it. Often, pipe is shipped one truck load at a time, for ditch-side delivery.

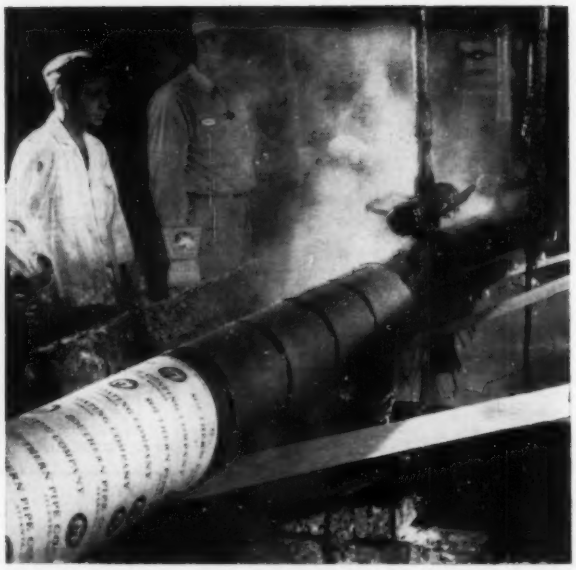
To handle this wide range of conditions, the operators have criss-crossed the large site with roads, 1½ miles of railroad tracks, and provided a maximum number of racks to feed bare pipe to the plant and also haul wrapped pipe to temporary storage. The original 17-acre site has been doubled in area to accommodate more storage area.

Pipe that must be processed as soon as it arrives is generally transferred directly by diesel-electric locomotive crane from truck or rail car to one of several feeding racks. Normally, pipe is placed in storage, and handled later by locomotive, rubber-tired cranes or small railroad transfer cars, depending on pipe size and several other factors.

A large part of the pipe is moved efficiently and economically by the transfer cars—freeing cranes for other use. Powered by small gasoline engines, these cars pull rail-type pole trailers of pipe from storage to the plant, and haul wrapped pipe from the plant to temporary storage. Small-pipe racks, made of structural steel joists, are set up at a level for easy hand rolling pipe to and from transfer cars.

All pipe is fed to the plant on a 400-ft long conveyor, straddled by racks of bare pipe ready for immediate processing. The conveyor is powered elec-



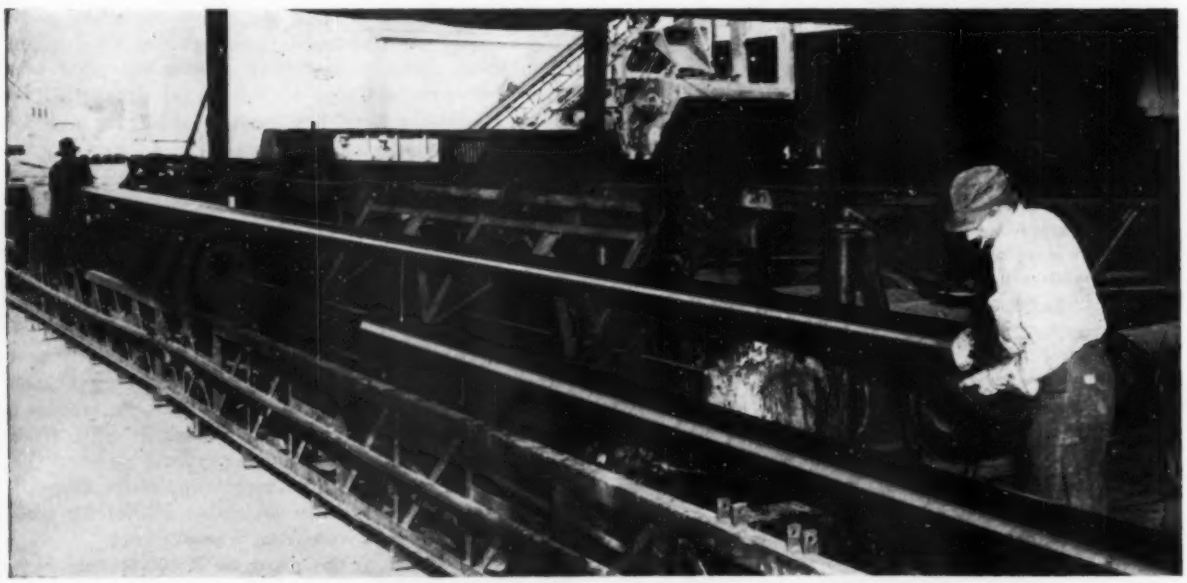


Above: Pair of large discs rotate and advance pipe joint through coating and wrapping process while pair of rollers prevents whipping of joints. All fixtures are adjustable for large range of pipe diameters. Right: Enamel, felt, and kraft paper are applied to rotating pipe as fumes are quickly exhausted. Leading end of pipe is supported by a track-riding dolly, which also trims and cleans end-weld areas. Second dolly picks up rear end of pipe when come-along plug is removed.

trically through mechanical drive. Drive mechanisms can be disconnected when end racks are not in use.

Pipe is transferred automatically from racks to conveyor. Vertical backstops, adjustable to any size pipe, receive and position pipe as it rolls from the rack. An electrical tripping device in the conveyor is actuated by pipe joints as they move along. As soon as one joint moves out of the way, a pneumatic device automatically flips the next joint from rack to conveyor.

First plant operation is cleaning. To help loosen scale, pipe joints are pre-heated, then passed through a modern Wheelabrator cleaning machine that hurls steel shot from below the pipe at extremely high velocities. This action blasts rust, scale and any other foreign matter from the pipe and cleans to bare metal.



Long Pipe joint is elevated automatically from conveyor to high gravity-feed rack. In background, coating dope is fed by belt conveyor to pair of heating kettles.

Left: Crane handles large load of coated and wrapped pipe with special slings to prevent damage.

Below: Small railroad transfer cars move bulk of small and medium size pipe to and from plant. Pole-type trailer can be lengthened for longer pipe.

Pipe is automatically primed as it leaves the Wheelabrator. An electrically heated, thermostatically controlled jacket around the primer container guarantees uniform temperature. From here, the joint is transferred automatically to one of two gravity-feed drying racks. A transfer elevator riding on rails can be moved easily to feed either rack. Both racks are mounted high to provide good ventilation and considerable storage area underneath.

Because of the warm climate in the Atlanta area, natural ventilation through open-sided buildings is normally sufficient for drying. In winter, however, sides are closed and heaters are used.

At the end of drying racks, pipe joints are transferred to a coating and wrapping conveyor by a pneumatically operated device. An operator pushes a button and two steel fingers nudge the joint from racks to conveyors.

On the large-pipe production line, a pair of large discs rotate to advance joints through the coating and wrapping process. These discs, one for each side of the pipe, are easily adjusted to fit any size pipe up to 30 in. A pair of small rollers fixed against the pipe just behind the discs prevent long joints from whipping as they spin through. A double pair is used on small pipe because of its greater whipping tendency.

Handling coating material has also been simplified. Dope is chopped from barrels at ground level and placed on a conveyor which feeds a pair of mechanically agitated, closed melting kettles. Thermostatically controlled hot material is pumped to the coating heads, while a system of fans and vents exhausts fumes.

As each joint emerges from the wrapping area, its leading end is supported by a track-riding dolly. When the rear end of a joint emerges, it is picked up by a second dolly. Dolly operators quickly trim and clean end weld areas while the pipe is still rotating.

The come-a-long plug that joins following pipe sections is removed by hand when it passes through final wrapping. Pipe is quickly ejected from the pair of dollies and allowed to roll to cooling ramps. SPC prefers this dolly system because of its simplicity.

The coating and wrapping process on the small-pipe line is almost identical, except that most of the machinery is smaller and simpler. A small hand-operated dolly supports the leading end of joints and padded saddles provide intermediate support.

After testing with holiday detectors, coated and wrapped pipe moves out of the plant in several directions. Pipe processed on the smaller line is transferred by hand to ramps made of padded steel joists. These joists are light enough to be moved easily by hand for accommodating various lengths of pipe. From here, pipe joints are rolled from under the north side of building to temporary storage.

Pipe processed on the larger coating line can be moved in two directions. Small pipe is moved out the north side of the building, while medium and large pipe is ejected from dollies and rolled to inclined cooling ramps toward the south side of the building. Built on casters to permit width adjustments, these ramps support only the uncoated pipe ends, and permit maximum ventilation under and around the still-soft coating.

After cooling, pipe joints can be loaded on trucks or cars, or moved to any one of several storage areas. Pipe can be rolled in a straight line from cooling ramps to storage racks, or shifted sidewise on transfer cards to the unloaded at additional storage areas. All ramps, racks, slings, truck and car bodies, and tie-down devices are thoroughly padded with excelsior to protect coating and wrapping. ■

Pemex builds a city . . .

and a gas system

By ALBERTO BERUMEN—Petroleos Mexicanos

NATURAL gas is no late comer to Mexico. Industrial consumers made the first use at Monterrey, N. L., in 1929. Delivery was through a 12-in., 153-mile pipeline between that city and Laredo, Texas—on the Texas-Mexico border. A predecessor company in what is now United Gas Corp. made the export.

In 1934, natural gas from La Presa field was connected to the pipeline. By 1948, all the gas handled was produced in Mexico.

In 1947, several industrial consumers associated and built a 14-in. gas line to the Texas border to pick up gas from La Gloria Corp., near Reynosa, Texas, and move it to Monterrey.

It is interesting to note that when the La Gloria Corp. contract expired in 1956, the Monterrey Industrial Pool purchased replacement gas from Pemex. And Pemex built a short gas pipeline from its absorption plant in Reynosa to the Rio Grande river crossing and sold gas to Texas Eastern—reversing Mexico's gas picture from importer to exporter.

Latest plans call for construction of a pipeline to bring natural gas from the Jose Colomo field to Mexico City. This line is currently under construction. The use of this gas in Mexico City and thereabouts will liberate large volumes of fuel oil that can then be used as cracking stock in refineries.

The productive Jose Colomo field was discovered in 1951. It is 35 miles east of Villahermosa, the capital of the state of Tabasco, Mexico.

It was decided to start camp operations with such installations as batteries and gathering lines, an absorption plant with auxiliaries, transfer lines, and injection wells and stations. Gas is being reinjected until the pipeline to Mexico City is completed. For these operations, a city had to be built.

The only surface area high enough above sea level and, consequently free from flooding, was located five miles southwest from the Colomo field. It was elected for the site of what is known as Ciudad Pemex (Pemex City).

This new city has been planned according to the latest trends with many modern improvements. It is now connected with the cities of Macuspana and Villahermosa by road. There is also a dirt road to Carmen, where a railroad station nearer to Ciudad Pemex is situated.

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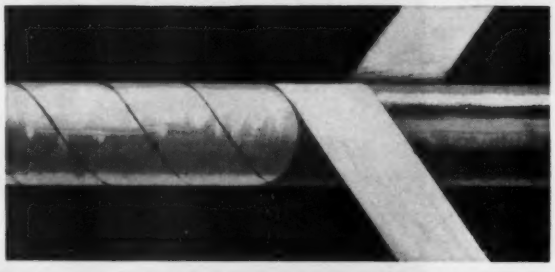


NICOLET INDUSTRIES, INC.

FLORHAM PARK, NEW JERSEY

Transco's 36-in. line goes through the marshes and over the ridge

THE JERSEY "MEADOWS" are in the distance, a no-man's land of muck, mosquitoes, and muskrats. Napp-Grecco laid some 8,500 ft of Bethlehem 36-in. pipe there.

LINE-UP CLAMPS READY, another joint is eased into place. The welded joints were X-rayed and hydrostatically tested.

Here's a pipe-laying job that beats 'em all for sheer orneryness.

Under a $1-million award, Napp-Grecco Co., of Newark, N. J., laid three miles of Transco's new, 36-in. looping line through the notorious New Jersey "meadows," then up and over the 300-ft-high rocky ridge bordering the Hudson River.

For six weeks the contractor's men and equipment slogged through the mucky meadows, at one point laying the pipe 16 ft below mean sea level. Then to the other extreme, drilling, blasting, and clawing their way through solid rock—working slopes so steep they had to anchor their backhoes to heavy tractors to prevent runaways.

To complicate things even more, it was necessary to burrow under a number of highways and, passing through city streets, they had to contend with a maze of underground utilities.

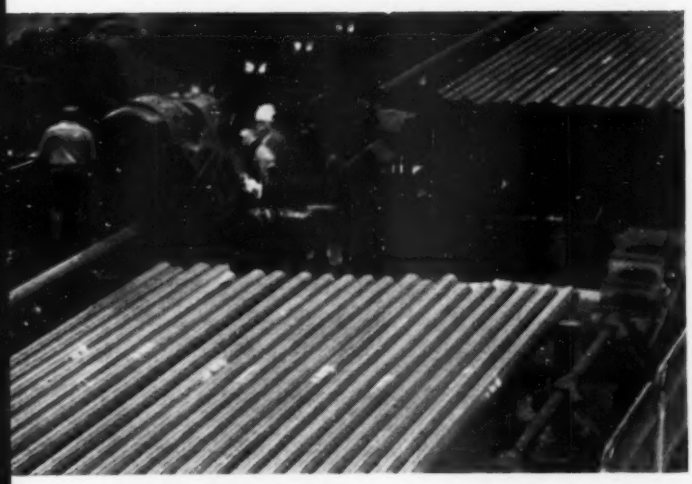
Finally, down the other slope they went, to connect up with dual 24-inchers recently laid across the Hudson River.

The pipe was Bethlehem's, widely used along Transco's 1800-mile-plus looping line from the deep South clear up to the streets of Manhattan.

Why not place *your* order for Bethlehem Line Pipe? It's available in any size you need, right up to 42 inches OD. *And with walls to ¾ in. in all the larger diameters through 42 in.*

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



ON TOP OF THE RIDGE, in a thickly populated area, the contractor had to thread the joints through a network of sewer, gas, and water pipes. Bethlehem produces expanded pipe with ¾-in. walls in the larger diameters, for use where higher safety factors are required.

BETHLEHEM'S ELECTRIC RESISTANCE-WELD PIPE was used for utility tie-ins all along Transco's main line. It's now available from 5⅝ in. to 16 in. OD in lengths to 60 ft. We also manufacture continuous buttweld pipe up to 4½ in. OD.

BETHLEHEM STEEL

The permanent installations for the Pemex operations are an absorption plant, power plant, boiler house, water pumping station from the Chilapilla river, settling pond, treating facilities, storage, office building, warehouses and workshops, service station, hospital, cafeteria and living quarters for employees and workers. The airport has a landing strip that can handle aircraft as large as Douglas DC-3's. It also has radio communications with Mexico City and the Pemex network.

Gas reserves were calculated using water and hydrocarbon saturation values based on the analysis of the electric logs, the thickness and the area of each horizon. Probably reserve total at 1 atm. and 20 deg C is 70.863 x 10^9 cubic meters.

Of this probable reserve, 90 per cent has been confirmed. With the existing information it can be stated that once the field is completely developed the proved reserves will equal the figures obtained in the study.

Several advantages and disadvantages were considered to determine the location of the injection wells. The system selected was along the minor axis of the formation promoting two sweeping fronts in the upper and lower zones.

The gathering system consists of three production batteries and two injection batteries. The gathering lines to the batteries are 3-in. Grade B pipe weighing 10.25 lb per ft and 14.33 lb per ft, respectively.

The gas flows from the wells to the station and is metered at wellhead pressure. Control chokes are installed downstream of the meter. These chokes regulate the flow on each well, maintaining maximum pressure on the header before the heater chokes. Minimum pressure drop can be attained depending on the number of wells on production and the amount of gas processed.

Pressure on the header will be 2500 psig before the heaters.

Final pressure on the main gas lines to the plant is 2000 psig at the stations, dropping to 1800 psig at the plant inlet.

Production flow control is determined by (1) number of wells producing; (2) control chokes for each well downstream of meter run; (3) choke control at the production heater inlet; and (4) automatic pressure control to gathering lines.

All the wells are equipped with Hi-Lo quick shutoff valves and are 600 to 5000 ft away from the gas production stations.

In the main 12-in. lines, Shafer-controlled Nordstrom valves close on 100-psig drop in case of line failure.

The plant installation also is protected with two safety valves set at 1900 and 1925 psig opening to the flare.

A fourth production station is presently under construction.

The gas condensate mixture flows to the inlet gas scrubber where the two streams are separated. The gas goes to three absorbers; the liquid goes to the condensate flash tank.

The quantity of oil circulated to the absorbers is controlled by a flow recorder controller which operates the turbine governor on the lean oil pump.

High pressure absorbers have 114 MMcfd capacity each, 1800 psig w.p.

The hydrocarbons absorbed by the lean oil consist of propane, butanes, and heavier constituents. In addition, the lean oil absorbs methane and ethane that must be removed to allow condensation of the heavier hydrocarbons after they are separated from the absorption oil.

The plant is capable of handling 400 MMcfd with the installed absorption facilities. But in the initial operation, since the gas line is under construction, the gas processed is equal to the recycle compressor capacity of 250 MMcfd. Five 2000-hp engines handle the 250 MMcfd of plant discharge gas boosting the pressure to 3900 psig and returning it to the reservoir. Seventy MMcfd of gas at 1000 psig will be available for immediate delivery as soon as the gas line is completed.

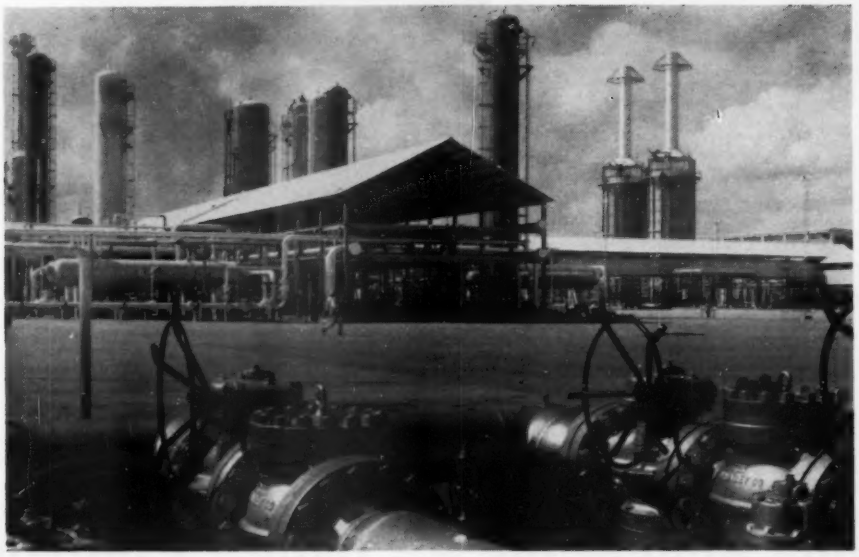
In designing the plant, the equipment has been arranged to ease additions to the plant and other facilities.

Rich oil from the absorbers is flashed in three states: (1) 1050; (2) 400; and (3) 150 psig—the gas from each stage being recompressed to the absorber pressure of 1840 psig.

When the gas pipeline is completed, the recompressors will compress to the pipeline pressure in two stages.

Two recompressors have been provided. In case one unit is down, the excess gas can be flared.

Stabilized condensate from stripper and deethanizer flows to pipeline surge tanks. This mixture flows from the surge tank through the primary and final



Northern section of the absorption plant.

coolers to the product transfer pump suction. The pump boosts the pressure to a maximum of 1000 psig or as required to pump the product to Minatitlan.

In case of high level, the pipeline surge tank dumps plant liquid product to the emergency product storage tank. A flash tank has been provided in the line to the emergency product storage. Liquid to the emergency product storage tank will have a vapor pressure of approximately 20 psig at the tank inlet. For this reason this tank will have approximately 6 ft of nonvolatile hydrocarbon, such as absorption oil or weathered crude, that will serve as a temporary means of absorbing the vapors formed in the tank.

As soon as the product is routed to the emergency tank, the condensate stripper and the deethanizer-depropanizer will operate to produce a depropanized and partially debutanized stable plant product.

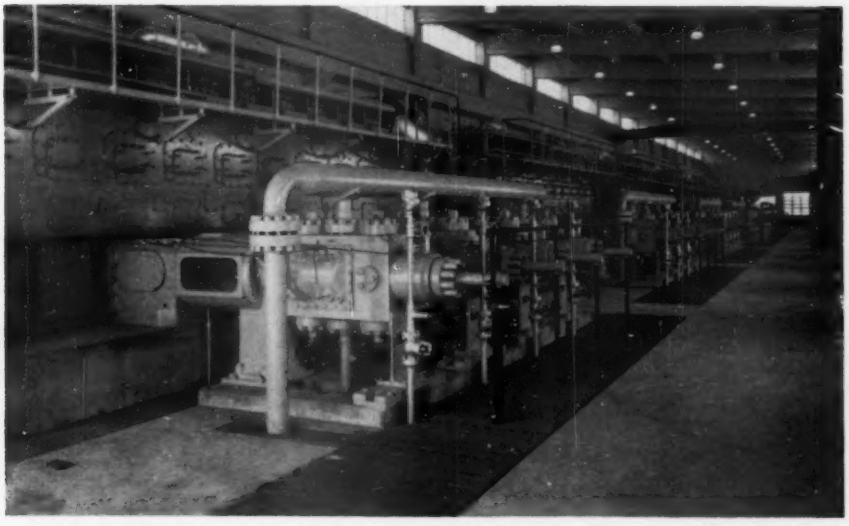
At present operating conditions, the plant product has the following approximate composition:

Component	*Mol. %*
C_3	24.62
IC_4	10.84
NC_4	17.23
IC_5	7.67
NC_5	9.48
C_6	22.57
C_7+	12.87
	100.00

The above composition yields 3.3 per cent propane, 40 per cent LPG (40-60), 51 per cent of 8# gasoline, and 5.5 per cent of kerosene.

The injection compressors handle the absorber residue gas from the residue gas scrubber at a suction pressure of 1800 psig. They compress the gas to approximately 4000 psig. Six 2000-hp engines have been installed. The gas then flows through six 6-in. injection pipelines to two injection stations located in the field area. Flow recorders and flow control chokes located downstream of the flow recorders control the flow of gas to each well.

The residue gas that will flow to the pipeline must be dehydrated to keep lines free of water and to prevent freezing of regulators and control valves. Two 75 MMcfd vessels are installed. They are arranged to allow the addition of one more, making a three-



Compressor engine room (4000 psig discharge pressure).

Frank Friedli, *Manager,*
En-Tronic Controls Division,
The Cooper-Bessemer Corporation,
explains...

How Cooper-Bessemer En-Tronic® Controls operate compressor station 26 miles away

This electronic control at Robinson Station transmits the signals for completely automatic remote control of the Columbiana Station 26 miles away. It receives and charts data from that station and provides an alarm and lights to indicate conditions at the remote station. All this is carried by a single line.

A part of the gas stored for East Ohio's customers is handled by their Columbiana Station. Here, they have recently replaced a 40-year-old engine-driven compressor with a Cooper-Bessemer GMXD 660 hp Packaged Compressor and En-Tronic Control. This entire installation operates automatically by push-button control from the Robinson Station 26 miles away.

A single telephone line and tone equipment provide a series of frequencies which control all operations... automatic sequencing, system alarms, data reporting, opening and closing of plug valves in the station piping, instantaneous shutting down of compressor in case of failure of power or communications and automatic starting when services are restored, and all other control and regulating functions. The compressor is self-lubricating.

The Cooper-Bessemer equipment makes possible better utilization of skilled operators, greater dependability of control, and a considerable economy in operation.

Why not investigate remote control for your compressor stations... both new and modernized. Call on us for help in evaluating the possibilities.

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Foreground: Cooper-Bessemer GMXD-10 660 hp Packaged Compressor at Columbiana Station. Background: Cooper-Bessemer En-Tronic Control which performs all engine and compressor control functions, actuated from the master station.

vessel system capable of dehydrating 150 MMcfd.

The fuel gas system for normal plant operation is taken from two sources. The primary source is from the depropanizer-reabsorber through a fuel gas scrubber. The secondary source is absorber residue gas.

It would take a book to describe the control equipment and arrangement of flow systems in the plant. It can only be said that from design to normal operation the whole project has been a success.

The gas line to Mexico City was the result of great demands for fuel in the industrial area of the state of Mexico and the Federal District close to the nation's capital. It was also found that the exploitation by depletion of the field is more economical. A better revenue will be obtained by reducing the recycled gas to the formation.

Probably there will be a partial program of reinjection depending on the conditions of the market during the 30-year period of the estimated field life.

In order to determine the location of the line, it was important to consider the consumption of fuel oil and probable consumption of gas in the areas where the gas line will go through. It is estimated that the fuel oil will be used as cracking stock and that a redistribution program will have to be planned.

The Mexico City-Atzcapotzalec refinery distributes 42,000 bbl per day of fuel oil. Demand is growing at least 4 per cent a year.

When the gas line starts operating at least 150 MMcfd can be sold in the Mexico City area. More can be sold if the gas now coming from Poza Rica in Veracruz is used for repressuring purposes.

The 24-in diameter line is 530 miles long. Inlet pressure will be 1000 at Ciudad Pemex while pressure in Venta de Carpio will be at least 150 lb as we regulate our distribution system at 100 psig.

Preliminary calculations show that with 150 MMcfd, the pressure drop is 610 psi. Consequently no booster station will be needed along the line.

In designing, we had to consider the 7600-ft difference in altitude between sea level and the plateau in Mexico City.

The Iron Mill Altos Hornos de Mexico is manufacturing the steel plate and Tubacero de Monterrey is making the pipe. By applying a special method of fabrication it is expanded from 22 to 24 in. while still giving the finished pipe adequate properties.

The construction job started with the location of the right-of-way, cleaning, drainage, hauling and distribution of pipe, excavation, alignment, welding, bending of pipe, insulating, painting, protecting against corrosion (magnesium anodes), pressure testing, burying and backfilling.

This gas line will have railroad, highway and river crossings that will be made according to the safety rules of the construction code.

Pipe characteristics are:

Outside diameter	24 in.
Wall thickness	0.344 in.
Weight	86.85 lb per ft
API specifications	5 LX-1958
Steel grade	X-52

Expected distribution of gas will be as follows:

MILLIONS OF CUBIC FEET

Year Operation	*Minatitlan*	*Veracruz*	*Puebla*	*Dist. Fed.*	*Total*
1	32	30	20	135	217
2	36	34	22	151	243
3	40	38	25	169	272
4	45	42	28	190	305
5	50	47	32	213	342

During the second year a 6000-hp booster station at Minatitlan will be required.

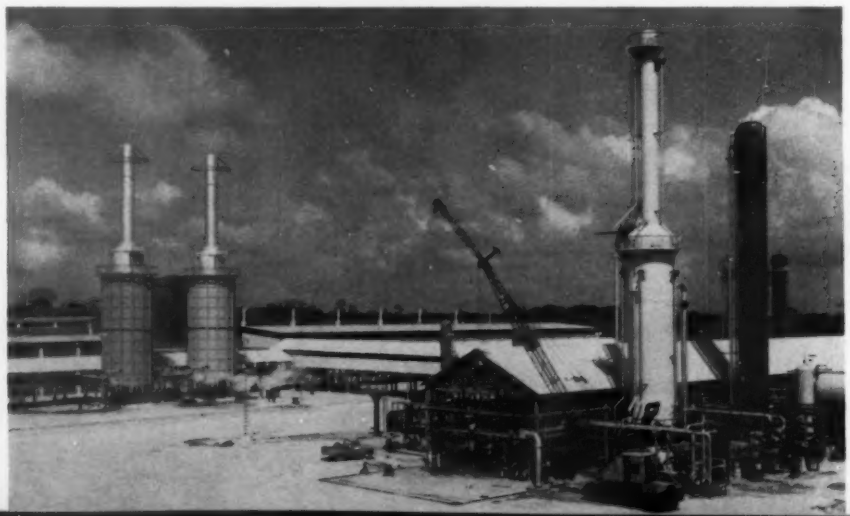
Later another booster station in Tierra Blanca with the same amount of horsepower will be installed. With the increase in compression capacity the line will handle 430 MMcfd economically.

There are several industries eager to use natural gas as fuel because of the advantages it offers. Also under study are plans to build petrochemical plants in remote areas close to the gas line.

Coatzacoalcos is a port in the Gulf of Mexico located in the Tehuantepec Isthmus where the river of that name flows into the sea. In the surrounding area there is abundant water, sulfur and salt. With the gas line and additional power from a thermo unit already in the process stage, it will be an industrial emporium in southeast Mexico.

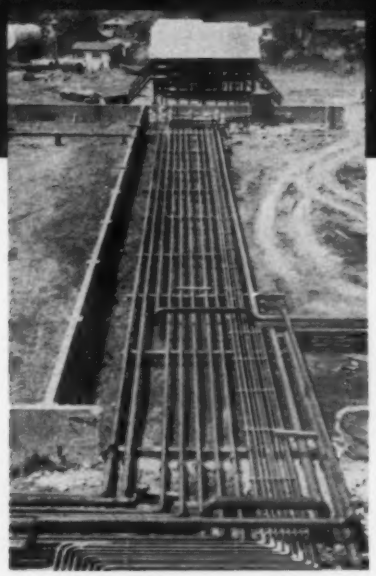
The area is connected by a railroad and highway to the Pacific Ocean at Salina Cruz, to Mexico City, and to the South border. ■

This article is adapted from a talk presented at the fall meeting of the CNGA.



Propanizer-reabsorber and deethanizer columns.

QUALITY PIPELINES



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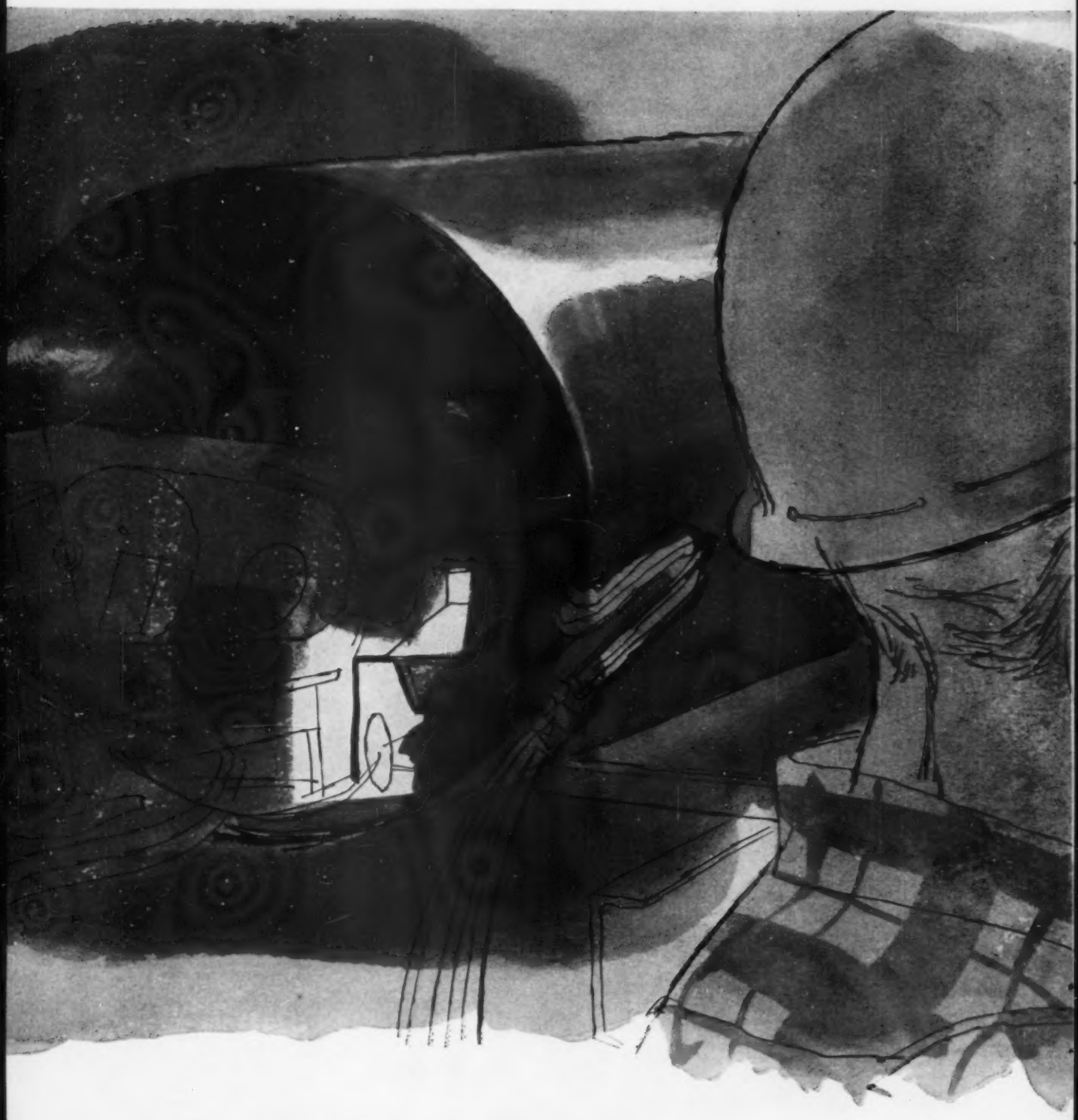

Spying on a weld

A TV camera is the spy! Located inside that hulking section of USS National Electric Weld Line Pipe, it's a visual guide to accurate welding.

The operator welds by remote control. He uses push buttons to operate a welding head inside the pipe. Just in front of the welding head is a short-focus TV camera.

When the image flashes on the TV screen, the operator sees reference lines and uses them as a guide. This enables him to keep the electrodes for the inside weld centered on the seam of the formed plate. *In short:* the TV camera makes precise guiding of the welding possible.

The constant development and improvement of production techniques are just two of the reasons why National Tube is not only the largest but also the most experienced manufacturer of tubular products in the world. For more information on USS National Line Pipe, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania. Ask for bulletin #23.

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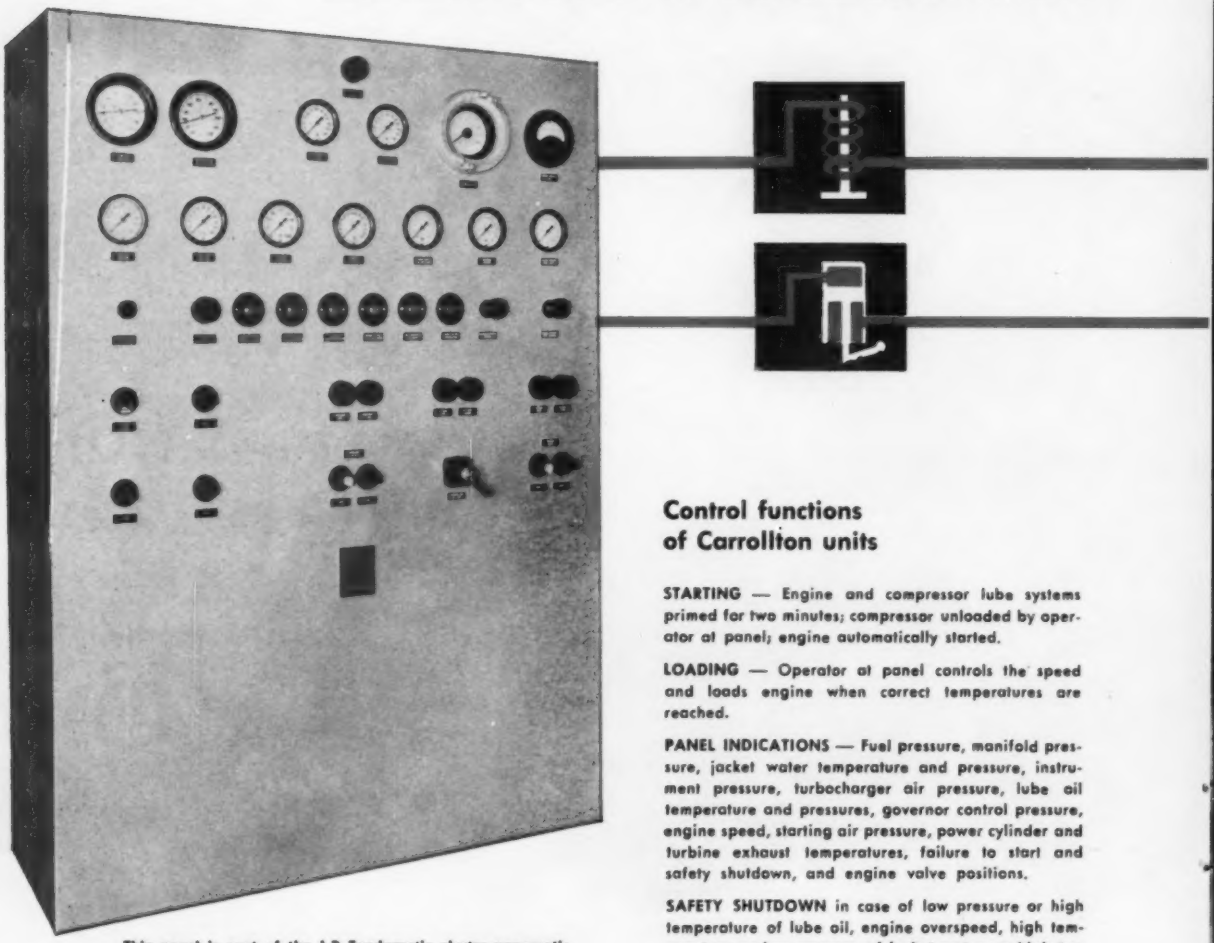


This panel is part of the I-R Tendamatic electro-pneumatic system which provides automatic control and protection of KVS gas-engine compressors at the Carrollton station.

Control functions of Carrollton units

STARTING — Engine and compressor lube systems primed for two minutes; compressor unloaded by operator at panel; engine automatically started.

LOADING — Operator at panel controls the speed and loads engine when correct temperatures are reached.

PANEL INDICATIONS — Fuel pressure, manifold pressure, jacket water temperature and pressure, instrument pressure, turbocharger air pressure, lube oil temperature and pressures, governor control pressure, engine speed, starting air pressure, power cylinder and turbine exhaust temperatures, failure to start and safety shutdown, and engine valve positions.

SAFETY SHUTDOWN in case of low pressure or high temperature of lube oil, engine overspeed, high temperature or low pressure of jacket water, or high turbine exhaust temperature. If emergency shutdown occurs, horn sounds and pneumatic indicators show reason at panel; fuel gas is shut off and later ignition is grounded.

NORMAL SHUTDOWN — Operator at panel actuates automatic sequence which unloads, slows and stops unit. Lube system runs for two minutes longer.

PIPELINE COMPANY. . .

compressor control features operation

for convenience and economy in starting and normal shutdown sequence control

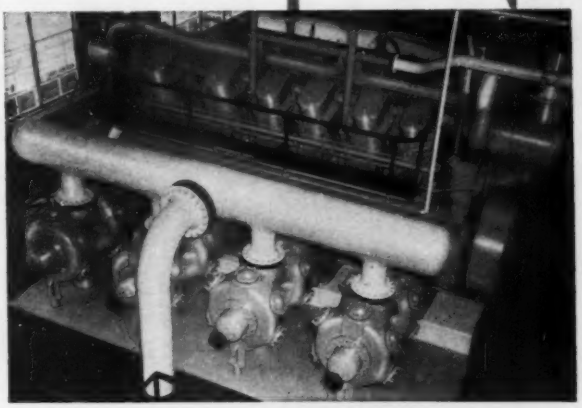
for safety and dependability in normal running and emergency shutdown control

At the Carrollton, Ohio, station of Tennessee Gas Pipeline Company, a division of Tennessee Gas Transmission Company, four 2000-hp Ingersoll-Rand KVS gas-engine compressors are operating under the constant vigil of a new achievement in automatic control systems.

This new I-R Tendamatic control installation combines the advantages of both electric and pneumatic operation in a single automatic control and protection system. Engine startup and normal shutdown are accomplished by electrical sequence control, permitting the use of compact electric timers, relays, etc. Once the compressor is loaded and on the line, the pneumatic system takes over the job of monitoring, indication and automatic emergency shutdown.

Therefore, the control and protection of the engine-compressors are independent of the electrical system, and a power failure would have no effect on successful operation.

Tendamatic systems can be supplied to meet any requirements — for remote, semi-remote, local, microwave, two-wire, multiple-wire, electric, pneumatic or hydraulic operation or in combinations. For more information, call your I-R representative.



Ingersoll-Rand 2000-hp KVS 4-cycle, V-angle engine-compressors at the TGP Carrollton station.

Only I-R compressors have Tendamatic control

Ingersoll-Rand

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Careful supervision of a wide geographical area over 100 miles in length is the watchword at Long Island Lighting Co.

The Long Island Lighting Co., a combination company, strives to maintain a 100% Load Factor, on purchased gas. Naturally, to avoid contract penalties the load variation requires careful supervision of the gas distribution system.

Only one dispatcher per shift controls the distribution system—24 hours a day, 7 days a week. Bristol telemeters put continuous status information at the dispatcher's finger tips: individual flows, pressure of gas at gate stations, amount of gas purchased at gate stations as well as status of the distribution system with pressures telemetered from important points on the Island.

Long Island Lighting anticipates that their gas load will more than double by 1962 and their Bristol instrumentation is flexible enough to take this increased demand in its stride.

Why not find out what Bristol telemetering can do for you? Better pressure regulation during unexpected demand periods, avoidance of contract penalties, security against interruption to service from abnormal conditions are just a few of the benefits you can expect. Distances can be anything from "in-plant" to hundreds of miles. Write: The Bristol Company, 119 Bristol Road, Waterbury 20, Conn.

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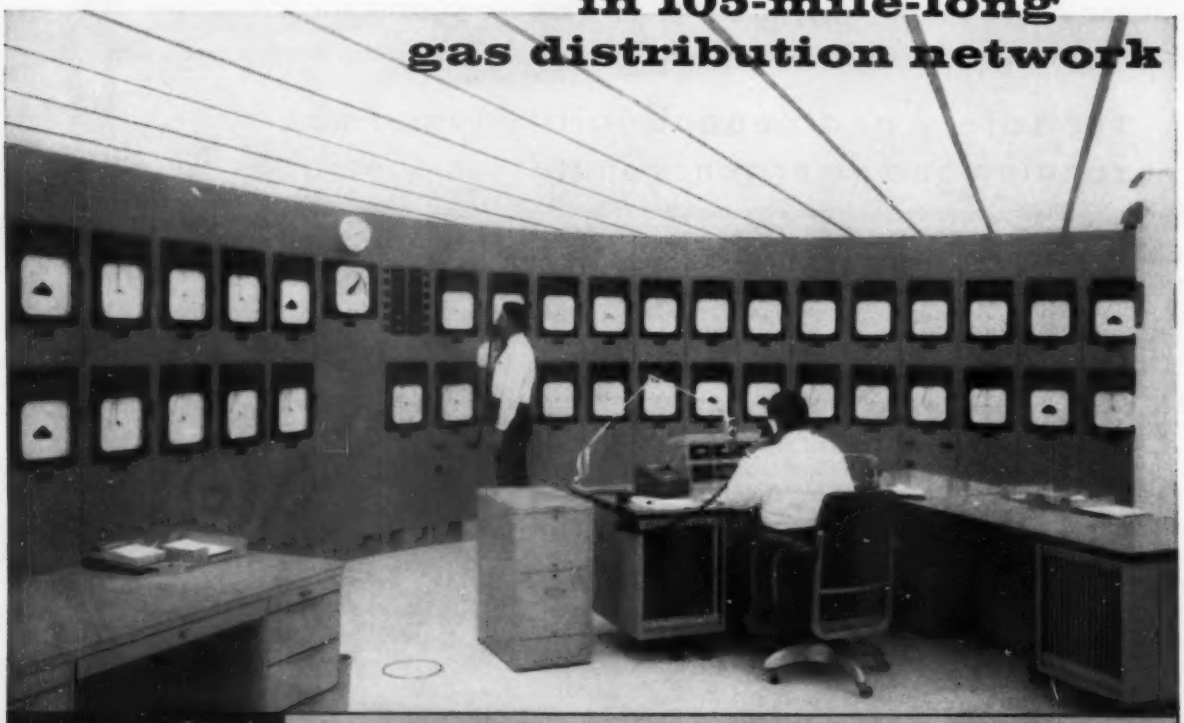
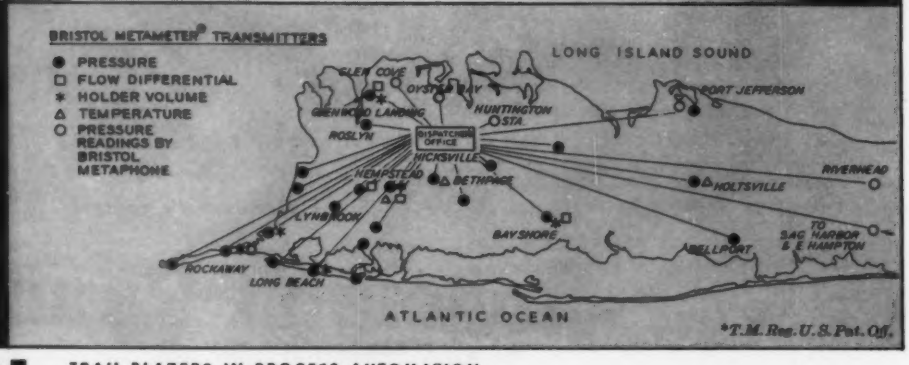
BRISTOL TELEMETERING helps maintain load in 105-mile-long gas distribution network



Bristol Metameter* Receivers on gas dispatcher's panel at Long Island Lighting Company's Hicksville, N. Y. Operations Center. These recording instruments make possible precision operation of a distribution network over 100 miles in length (see map).



*T.M. Reg. U.S. Pat. Off.

BRISTOL *TRAIL-BLAZERS IN PROCESS AUTOMATION*
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Communications and Automation

Edited by FRANK CHAPMAN

Power for microwave repeaters

By F. VINTON LONG

THE best microwave repeater is of course none at all.

But if we must have one it must keep operating.

One of the main reasons it sometimes quits operating is that it runs out of power.

This happens when the main a.c. source of power fails and the standby doesn't work.

Right now, there are two ways to provide better protection for important microwave links, where even short outages are costly. One is to use a continuously rotating alternator powered by an electric motor, in turn connected to a quick-start engine through a magnetic clutch (such as the United States Motor unit), or use storage batteries for main power, with charging from the commercial a.c. power mains plus a standby d.c. generator charger powered by an engine (the way the telephone companies do it).

Either method will greatly help our operation.

However both are expensive and involve a lot of equipment and/or moving parts.

There is a better way which is ideal for small pipeline or utility repeaters. However, to use it, the whole system must be designed with one thing in mind.

This thing is the use of simple repeaters.

These repeaters can be made simple by:

1. Use only low towers with no tower lighting.
2. Don't drop off service channels or other forms of drop and insert equipment. If the serviceman must talk to the next station let him use his VHF. But he shouldn't need to talk if he carries with him Plug-in Spare East and West transmitters and receivers.
3. Use transistors, or better yet, some sort of a through repeater such as a traveling wave tube.
4. Mount it in a tin box strapped on the tower.
5. All of this boils down to low main power requirements.

Once you have that licked, there are several ways to go.

You can run the station off of inexpensive batteries and keep them charged with commercial power, solar energy, or thermoelectric converters.

Of all these the thermoelectric technique seems most promising, if you happen to have fuel gas available. In fact if you use them, no storage battery might be necessary. Right now Westinghouse Electric has announced the TAP-100, which is a 100-watt unit which probably could use a gas-fired heater, and 100 watts would easily take care of the simple station outlined.

Also, the TAPCO Group of Thompson-Ramo-Wooldridge Inc. is developing a self-contained solar-power electrical system for a space vehicle which might possibly be used on pipelines. They use a boiler system with mercury as the heat exchange medium. The vaporized mercury is stored and used to drive a long lived turbo-alternator.

No manufacturer can convince me that this could not be done. ■

Mobile communications reps named by RCA

Manufacturers representatives in Texas, Montana, Maryland, and Indiana have been named for RCA's mobile communications equipment.

They are: Texas Gulf Electronics Inc., Houston; Leslie E. Olsen Co., Lewistown, Mont.; Communications Sales Co., Salisbury, Md.; and Industrial Communications of Indiana, Indianapolis.

The four firms will handle two-way radio equipment, including the new LD-150 transistorized mobile unit.

RCA has named Norman Caplan to head industrial electronic products activity in the Washington-Canonsburg, Pa. area. He will supervise the present RCA plant at Canonsburg and the new plant planned near Washington.

Philco appoints

Joseph M. Hertzberg is vice president-marketing for Philco's government and industrial group. The government and industrial groups include computer, industrial, communications and weapons systems, Western Development Laboratories, Palo Alto, Calif. and Sierra Electronics Corp., Menlo Park, Calif.

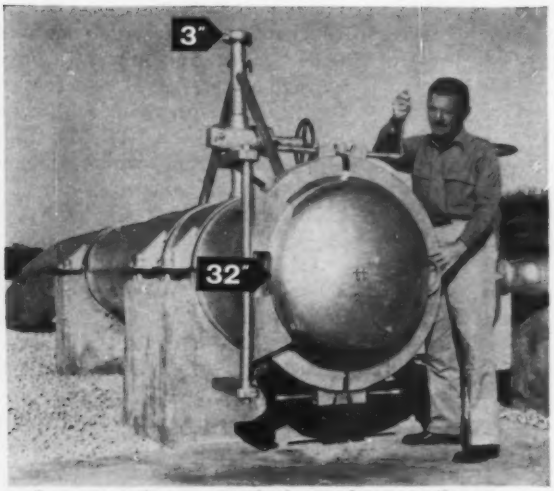
G-E makes appointments

Peter G. Smee has been appointed manager of microwave systems designs for General Electric's communication products department in Lynchburg, Va. He joined G-E in 1946 and specialized in microwave engineering for the past several years.

The company named Elmer W. Hassel as manager of tone-signalling and filter design engineering. The newly created position involves responsibility for design of terminal communication equipment, quartz crystals and filters for G-E's two-way radio, microwave, and carrier current products.

NEW...FROM TUBE

an improved hinged closure for pipe lines, piping and process equipment



One man, using any standard wrench, can easily open or close the TUBE-TURN *Hinged Closure. Has important safety features, too!*

Tube Turns announces a new line of hinged closures with important advantages for pipe lines, piping and process equipment wherever frequent access is required or where the use of blind flanges would be cumbersome and time consuming. Proved in scores of applications by major companies, the unique TUBE-TURN* Hinged Closure provides these benefits:

Saves installation time. Light weight assembly easier to handle. Completely fabricated . . . ready to install. Requires only one butt-weld to join to pipe, tank or vessel opening.

Saves operating cost. One man, using a standard wrench, can easily open or close the largest size closure in a few minutes. No threads or lugs to engage or flanges to line up. No parts to fail. No hammering or tugging. Can be adapted to motorized operation. Closures for vertical applications can have counterbalanced caps for easy operation.

Saves on maintenance. Oil resistant, self-energizing static "O" ring provides seal. Does not move when cover is opened or closed. No rubbing or chafing to shorten seal life.

Built-in safety. Exclusive design features of two-piece yoke, double-ended right- and left-hand threaded bolts and hinged cap guard against accidental opening under pressure.

These new TUBE-TURN Hinged Closures provide still another *plus value* you can get when you specify TUBE-TURN products and buy them from your nearby Tube Turns' Distributor. They are available in sizes 2" through 42" for A.S.A. 150-lb, 300-lb and 600-lb service . . . in steel or alloys.

*"TUBE-TURN" and "tt" are trademarks of Tube Turns.

For vertical applications, TUBE-TURN *Hinged Closures can be equipped with spring-loaded, counterbalanced caps.*

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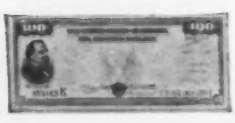
L. P. HOLLAND, skilled refinery technician, is typical of thousands of key employees in this field who are buying U.S. Savings Bonds regularly. Mr. Holland, through his company Payroll Savings Plan, is making a personal contribution to the Peace Power of our country.



GAS MAGAZINE

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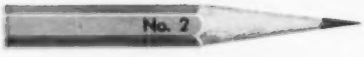

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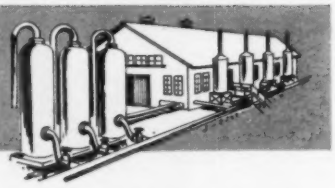
GAS PIPELINE NEWS



Trunkline expands and experiments

THE second major expansion program within a year was announced by Trunkline Gas Co., Houston. The company will make experimental installation of small, lightweight, ultra-highspeed combustion gas turbines this year.

In its expansion move, Trunkline asked FPC authority to increase its daily delivery capacity by 200 MMcf. The program will cost some $45 million.

All of the increased natural gas delivery will be to Panhandle Eastern Pipe Line Co. at Tuscola, Ill. Panhandle is expected to file for a companion expansion program to enable it to further meet the requirements of its 60 public utility, municipal and industrial customers in 10 states.

Trunkline's expansion is scheduled for completion by Nov. 1, 1960 —based on early approval by FPC. After the project is completed, Trunkline will have a daily capacity of 710 MMcf. The pipeline company told the FPC it has 4.5 trillion cu ft of gas reserves to back up its expansion filing.

Trunkline is winding up its $82 million, 135-MMcfd 1959 expansion program. The 1960 program will result in 252 miles of mainline loop and 140 miles of lateral lines, along with necessary compressor hp additions, to produce a system of two parallel large-diameter pipelines from Texas' lower Rio Grande valley to Tuscola.

The new turbines:

Two very small and light UHS (ultra-highspeed) gas turbines will be tried out for gas pipeline compression application by Trunkline. Such units have never before been tested for gas transmission service.

One is a G-E T-58, a power unit more at home in a helicopter. It will develop 825-hp to turn a double-shaft centrifugal compressor. The other is a Solar Aircraft Co. T-1000, which will be directly coupled to deliver its 1075 hp to a Solar-designed double-shaft centrifugal compressor.

Solar also has designed a waste-heat expander turbine that Trunkline plans to install. The single unit can be used with either compressor, adding 325 hp to the G-E unit and 425 to that made by Solar.

In its application to FPC to install and test the small UHS turbines, Trunkline points up savings in cost per installed hp over two-cycle reciprocating, four-cycle reciprocating, and conventional gas turbine compressor stations.

If a one-year trial period proves out these new (for gas service) units, Trunkline Gas Co. will have made a dynamic advancement to the art of gas compression and pioneered an answer to one of the gas industry's most critical problems—cutting capital costs.

New Canadian imports edge closer

SLOWLY, but no one knows if surely, the National Energy Board in Ottawa edges closer to authorizing yearly exports of Canadian-produced gas to the U. S. that exceed in volume the yearly consumption of natural gas in Canada.

The following events have been noted during the hearing. In late January, some Canadian gas transmission company stocks slipped about $2 per share due, perhaps, and in part, to disappointment over the snail's pace of the proceedings. Perhaps it reflected the fear that time is running out for exporting companies that must firm up purchase deals for compressor station units and equipment by about the end of March.

The next event of note was the dropping of opposition to additional exports by Northern Ontario Natural Gas Co. They put up a strong battle to prevent Trans-Canada Pipe Lines from exporting to Midwestern Gas Transmission because Northern Ontario had been unable to sign a suitable contract with the Canadian pipeline firm to secure additional gas for their (NONG) customers. However, this was resolved when Trans-Canada and Northern Ontario did sign a new contract for plentiful long-term additional supplies of gas at favorable prices for the Northern Ontario market. As this action was firmed up, Northern Ontario Natural suddenly withdrew its objections.

Then, a producer was heard from. Imperial Oil Ltd. said, in early February, that continued restriction on the export sale of Canadian gas probably would cause the gas price increase it intended to prevent. Its brief, filed by the Canadian Petroleum Association, stated that fears of price increases if Canadian gas exports are allowed have been greatly exaggerated.

Westcoast Transmission told the NEB that if the allied Alberta & Southern Gas Co. gas export plans are not approved, Westcoast will work out its export plan without A&S participation. Frank McMahon, Westcoast's president, has said that the export proposals could result in a $1-billion investment in natural gas exploration, drilling, producing, processing plants, and pipelines in Canada.

Witnesses for El Paso Natural Gas Co. told the board that Canadian gas supplies are absolutely necessary for its plans to supply the future market in the Pacific Northwest. And Pacific Gas & Electric people explained that natural gas from Canada plays an important part in its plans to serve the future demands of its San Francisco and northern California service area.

Many things are involved from straight politics to inadequate reserves. The politics are an unanswerable factor, but it is hard to comprehend how NEB could dismiss the export plans on the basis of inadequate reserves unless they seriously question the Alberta Oil & Gas Conservation Board's technology and methods after the latter has stamped the reserves with an okay.

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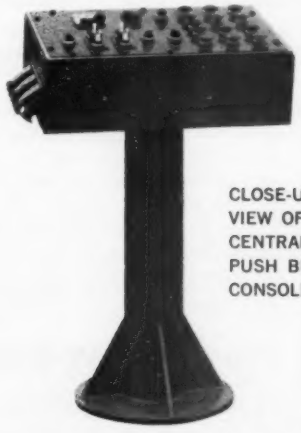

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CROSE announces the newest development in pipeline construction equipment. The Crose internal cleaning and coating machine is the fastest, most efficient machine on the market, requires only two basic cleaning heads for all pipe sizes from 16" through 36", and is available on a for sale or lease basis. This electric-driven machine comes complete with pipe handling and spinning rack. Requires a minimum crew of four men . . . can be moved easily from one job site to another, or can be permanently installed.

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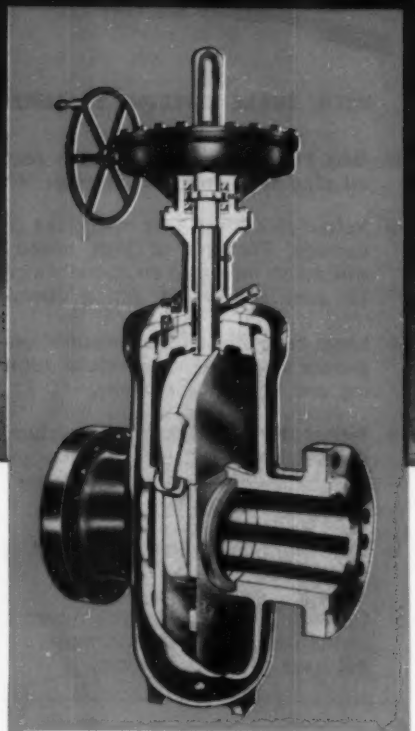

W-K-M Leverlock® Gate Valves feature through-conduit gate construction, parallel expanding gates, exclusive gate centralizers, controlled force seating, pressure seal bonnets, super-finished stems, seating surfaces sealed from the lading flow — and can be overhauled on-the-line.

Pressure Ratings: ASA 300 through ASA 1500 pounds.

Product of W-K-M's *Creative Engineering*

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Chasekote*

— *polyethylene* protective tapecoating is ready to wrap, right from the roll. No heating or drying time. Extra-heavy adhesive mass is a *built-in* primer . . . assures fast, permanent tape-to-metal bond.

Chasewrap*

— *abrasion-resistant* overwrap provides a tough, wrinkle-free shield against backfill and soil stress. Wraps simultaneously with tape. Superior to rag or felt overwraps, yet lower in cost.

*Trade name of Chase & Sons, Inc., long-famous for protective and insulating tapes for electrical wire and cable.

Put the squeeze on your pipe wrapping costs! Start by cutting your present hot-coat labor crews *in half*. Forget about heavy investment in applicating equipment. Get more footage a day *without* material waste and clean-up problems. How? It's simple. With the new CORR-PREV Pipe Coating Team, you have everything you need — *including* high-speed machinery — for faster, easier, more economical pipe wrapping . . . plus unequalled pipe protection against underground moisture, galvanic and chemical corrosion.

The New CORR-PREV Pipe Coating Team

Try this new pipe coating *team* on your next job. From trenching to backfilling, CORR-PREV helps you shorten your spread . . . gives you a pipe coating that's *factory-uniform* in quality and thickness. Most important, you get today's *proven* polyethylene pipe protection at the *lowest applied cost!* Write for sample rolls, specifications and prices. **CHASE & SONS, INC., 26 Spruce Street, North Quincy, Mass.**

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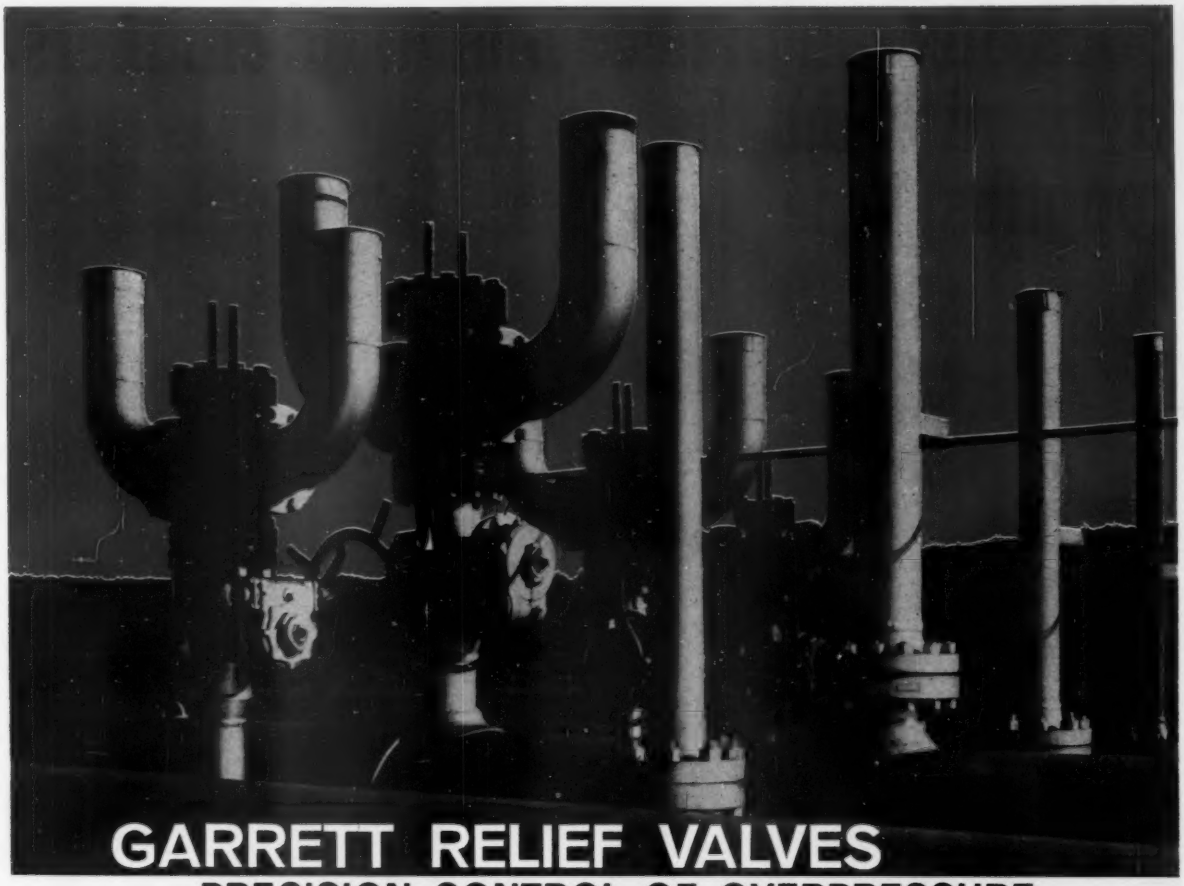

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Less than 1 percent of pressure differential will actuate a Garrett Relief Valve. This exactness of control is maintained over hundreds of reset cycles.

When conditions change or the valve is used on other service it can be readily adapted to new set and blowdown pressures. The valve body is not removed from the line to test or reset pressures. Servicing is equally easy and can be done with ordinary hand tools and wrenches without removing the valve from line or vessel.

Automatic blowdown service or safety shutdown can be provided for all Garrett Relief Valves already installed or furnished for new installation.

Garrett field engineers are available to assist in planning your relief valve requirements, write or phone.

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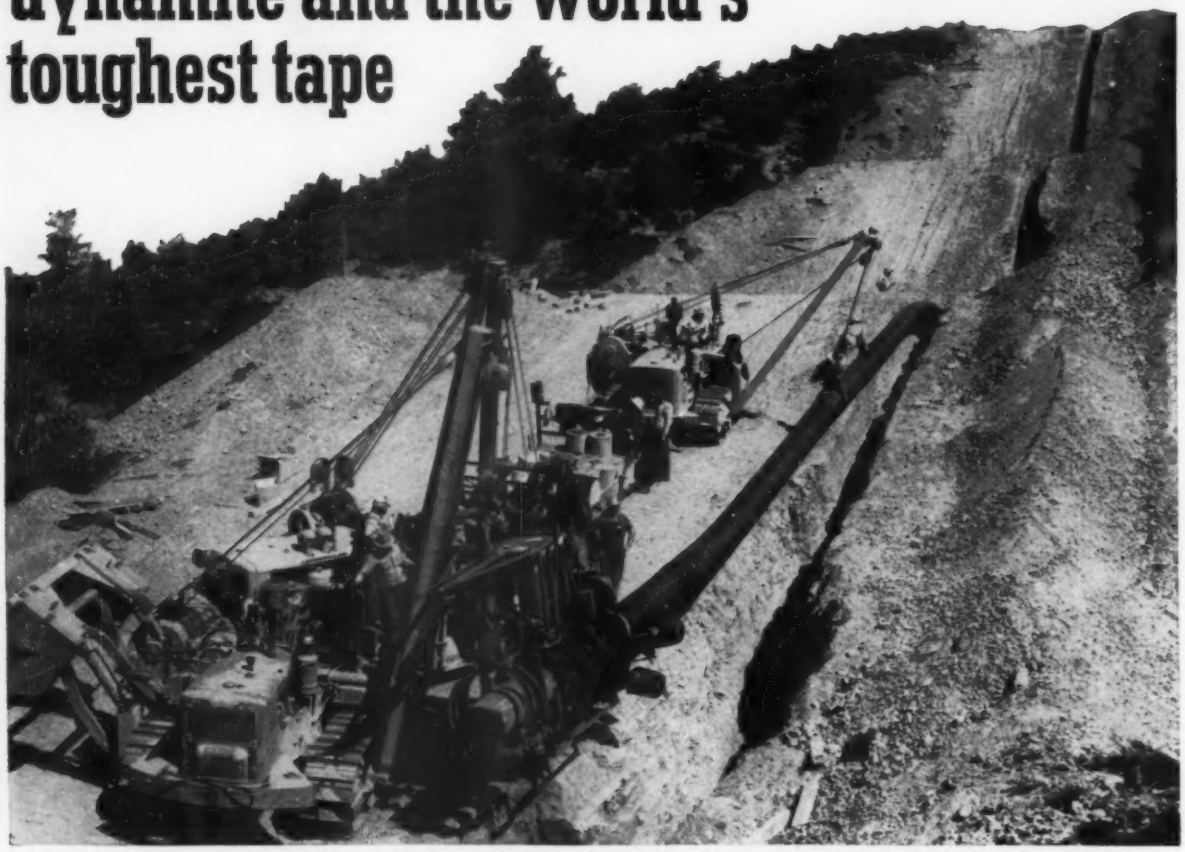


New Mandalay line protected by Polyken Extra-Strength #960

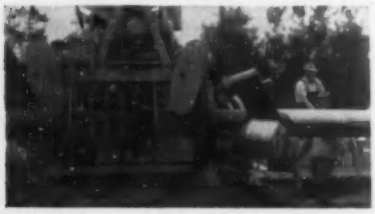
Putting in Richfield Oil's Mandalay Line was as mean a job as we've ever seen.

The line runs from sea level to points up to 8,300 feet in the mountains of Southern California, with grades over 40%. In places the trench was blasted out of solid rock. It took rugged crews to put the line in and a rugged tape to protect it.

On the recent big Florida Line and other lines in America, on lines in Canada and in Iran, Polyken has proven itself the most practical and economical protection you can put on a pipe.

Polyken tape pays off in performance—and in the currency of less men, less equipment, greater efficiency, more footage per day during construction. With tensioned-spindle equipment, pipe is cleaned, wrapped and over wrapped in one factory-smooth operation. Tape's ready. No primer, no drying or cooling, no fumes or fire hazard—none of those hot-dope problems.

Before you plan your next job, we'd like to tell you more about Polyken Extra-Strength #960. Call the Polyken distributor nearest you, or write Polyken, 309 West Jackson Blvd., Chicago 6, Illinois.



Polyken Tapes can be applied swiftly, easily, effectively, even under extreme conditions. This mountain-country coating went on with flat-country simplicity. That's why more contractors and pipeline managers are specifying Polyken.

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Midwestern Pipe Line Products Co.

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Northern plans 75 MMcfd sale

NORTHERN Natural Gas Co. has asked FPC approval of plan to serve Michigan-Wisconsin Pipe Line Co. 75 MMcfd. Northern also wants to increase its gas supply to presently served customers by 78 MMcfd for the 1960-1961 heating season.

To meet the Michigan-Wisconsin deal, Northern proposes to build 82 miles of line from its present terminus at East Dubuque, Ill. to connect with the Michigan system at Janesville, Wis.

In the second filing, Northern proposes to make an added 40 MMcfd available to Northern Illinois Gas Co. and 38 MMcfd available to other utility customers.

This marks the seventh consecutive year in which Northern has successfully fulfilled all the increased gas needs of the towns and cities on its system.

In the Michigan-Wisconsin application, Northern stated its intention of filing later for a permit to serve some new communities, including a number in Wisconsin.

In addition to the Janesville extension, Northern plans to build 154 miles of loops and add 14,050 compressor hp.

Estimated cost of this project is $24.9 million.

Facilities required to increase gas supply to present customers include 103 miles of mainline loops, 20 miles of branch line loops, and the addition of 17,360 compressor hp. Cost is estimated at $16.6 million.

Michigan wants capacity hiked

MICHIGAN Wisconsin Pipe Line Co. asked the FPC to approve further expansion of its facilities to increase system capacity by 333 MMcfd in 1960.

The complete expansion program of the American Natural Gas affiliate will cost about $73.5 million.

About 65 per cent of the additional gas supply will be purchased by American Natural's distribution subsidiaries, Michigan Consolidated Gas Co. and Milwaukee Gas Light Co.

Michigan Wisconsin wants specific approval to proceed with two major construction programs which will provide large volumes of gas from two separate sources. The two sources, plus the company's Canadian program, will increase peak capacity of Michigan Wisconsin's system to almost 1.5 billion cu ft per day.

In the largest of the new programs, Michigan will construct 568 miles of pipeline loops paralleling its existing pipeline. This will enable it to take 100 MMcfd more gas per day from the Laverne gas field in Oklahoma. The loop lines and the addition of 6000 compressor hp in existing stations will cost $44.8 million.

In a separate filing, Michigan Wisconsin asked approval to buy 75 MMcfd from Northern Natural Gas Co. (See accompanying story.) Michigan Wisconsin will spend $4.3 million on 30 miles of 30-in. loops and 3000-hp of compression to receive the gas near Janesville, Wis. and move it to its utility customers.

Examiner okays producer sales to United Fuel

An FPC presiding examiner granted permanent certificates to a group of independent producers covering gas sales to United Fuel Gas Co. (Dockets G-15047 and 15813). Gas will come from new sites in the Erath field, Vermilion parish, La.

Sales were being made under temporary certificates issued by the FPC in 1958.

Presiding Examiner R. W. Weston said the only issue in the case was whether the sales should be permanently certificated at a rate of 20.6 cents per Mcf, as contended by the FPC staff. The producers argued for 21 cents. The examiner ruled the rate should remain at 20.6 cents, the level set at the beginning of service.

Walworth valve renamed

Walworth Co. has renamed one of its traditional lines of valves. "Rolotork" is the new name for the company's high pressure, steel, ball-bearing lubricated plug valves.

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TGT-Midwestern file '60 plans

ON file with the FPC are new applications from Tennessee Gas Transmission Co. and affiliated Midwestern Gas Transmission Co. involving $48 million in construction. Of the total, $43 million is for TGT; $5 million for Midwestern.

TGT's principal project would provide 204 MMcfd of additional gas required by 50 existing customer companies, including Midwestern, for the 1960-61 winter. Facilities include 155 miles of 36-in. and 30-in. line paralleling the existing system in Ohio, Pennsylvania and New York. There would also be 72 miles of gas gathering line and 31,300 hp additions to five system stations.

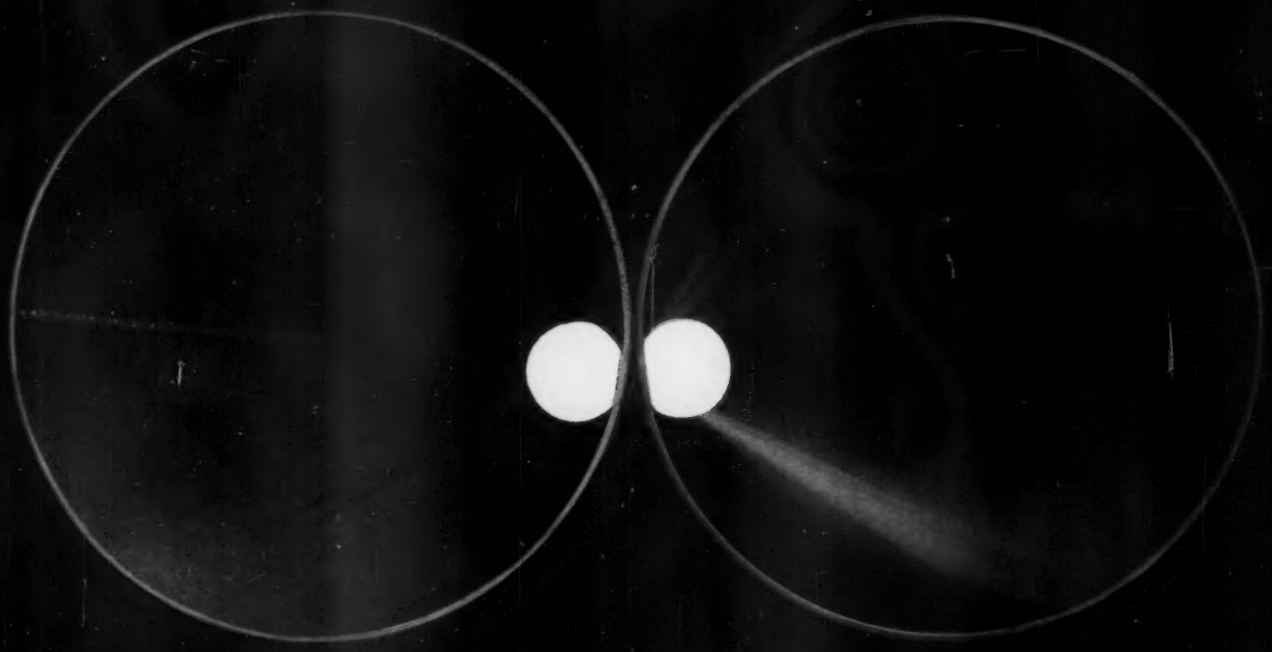
Midwestern's largest application was to add 14,000 compressor hp to its system and provide an additional 40 MMcfd and 20 MMcfd, respectively, to Northern Illinois Gas Co. and Peoples Gas Light & Coke Co. It also would furnish nearly 5 MMcfd for the combined needs of Midwest Gas Pipeline Co. and Allied Gas Co., two firms planning new pipelines in Illinois. Midwest would serve Martinsville, Marshall and Casey; Allied would deliver to Gilman, Onarga, Cissna Park, Rankin and Potomac. All eight Illinois towns are now without gas.

In two smaller related filings, Tennessee Gas proposed to install 6500 more system compressor hp to provide Midwestern with an additional 20 MMcfd. And, Midwestern applied to sell the 20 million to a new customer, Illinois Power Co. of Decatur, Ill.

Construction of these new facilities, plus that of other facilities authorized but as yet unbuilt, would increase Tennessee's average day capacity to about 2.8 billion cu ft per day. Its peak-day capacity, using underground storage, would rise to 3.2 billion per day. Midwestern's capacity would increase to more than 436 MMcfd.

Montana-Dakota files

Montana-Dakota Utilities Co., Minneapolis, wants to construct 15.5 miles of 6⅝-in. transmission line and 2 miles of 4.5-in. field lines in Montana (Docket G-18604). Also involved in the $1 million building program is 1540 additional compressor hp, a meter and regulator station, and dehydration facilities.



The uncoated mill pipe pictured above, left, was the last section in a 225,000 ft. string of 30" line pipe internally coated by L. C. Russell for Transco at the Steelton yards of Bethlehem Steel Mills. At the right Napko's Epoxycote Pipeliner, the first amine-cured epoxy resin specifically formulated for gas line transmission, imparts to the finished section a surface smoothness that will increase line-flow efficiency and reduce maintenance costs.

6% INCREASE IN PIPELINE FLOW EFFICIENCY WITH NAPKO EPOXYCOTE PIPELINER!

Extra Thru-Put and Cleaner Gas at Lower Maintenance Cost

Throughout the United States pipeline engineers report that lines internally coated with Napko's Epoxycote Pipeliner show record improvement in thru-put, product purity, and line maintenance economy.

Studies indicate that the walls of coated pipe have an average relative roughness of 280 micro-inches, compared to an average of 700 micro-inches in unweathered mill pipe. Weathered pipe in a mild environment in as little as 60 days can attain a surface roughness up to 1500 micro-inches (an additional 2-5% loss in efficiency).

Leading internal coating specialists such as L. C. Russell Company, Rosson Richards Company and H. C. Price Company testify to the dependable behavior of Epoxycote in both application and finished film properties.

For complete details and published project references write to

TESTED FEATURES OF EPOXYCOTE PIPELINER

PREVENTS PITTING IN TRANSIT & STORAGE: In industrial atmospheres, humid regions, and particularly marine areas, severe pitting can occur in uncoated pipe. Epoxycote moisture and chemical resistance virtually puts an end to pitting.

REDUCED CLEAN-UP EXPENSE: Pigging a new line to remove loose rust and millscale can cost up to 17¢ a foot, but after cleaning and lining with Epoxycote, a single plug is usually sufficient. Napko Epoxycote has maximum hardness to help prevent pigging damage.

CLEANER LINES & GAS: All rust and loose millscale can not be removed from uncoated pipe by pigging. Prior lining with Epoxycote minimizes load on scrubbers, with the cleaner gas ultimately reducing service of consumer gas appliances by the gas distributing company.

INCREASED CAPACITY: Friction losses are reduced by smoother internal surface.

PREVENTS INTERNAL CORROSION: Minute traces of moisture, oxygen, and such contaminants as hydrogen sulfide, accelerate pitting of uncoated pipe. Epoxycote Pipeliner is chemically resistant to the corrosive impurities of natural gas, insuring maximum protection of the line and the product.

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INDUSTRIAL COATINGS DIVISION

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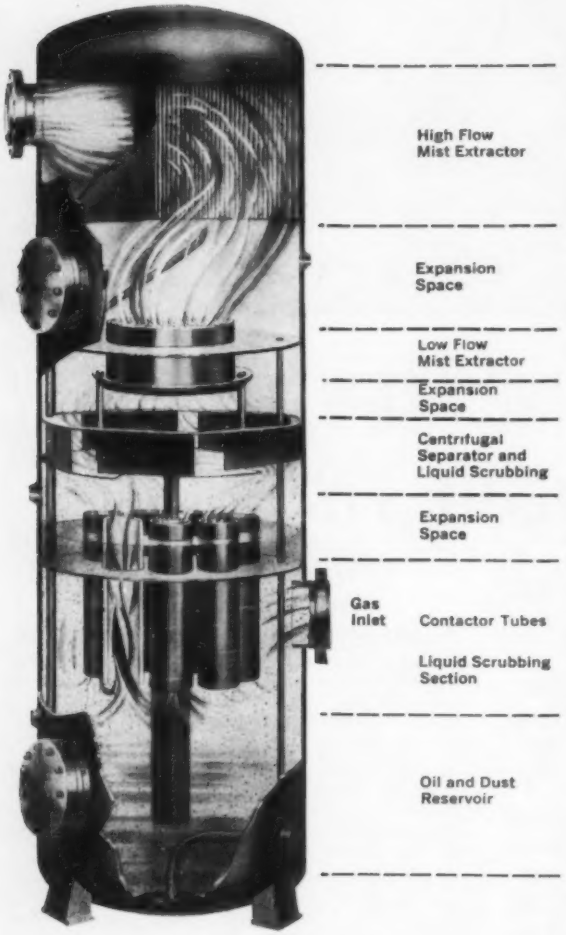
GAS CLEANERS

handle high volumes ...extreme load swings



Multi-phase design removes pipeline dust regardless of particle size . . . features four phases of scrubbing and six phases of separation . . . requires no moving parts. ▪ Oil loss is held to .03 gallon per million cubic feet. The "M-P" protects compressors and regulators, keeps lines open. ▪ Send for Bulletin 388. Buflovak Equipment Division, 1547 Fillmore Avenue, Buffalo 11, N.Y.

Buflovak Equipment Division

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GAS CALENDAR

March

3-4..AGA-PCGA Joint Public Relations Conference—Santa Barbara Biltmore, Santa Barbara, Calif.
3-4..SGA Distribution Section—Jung Hotel, New Orleans.
3-4..SGA Transmission Section—Jung Hotel, New Orleans.
14-18..National Association of Corrosion Engineers Annual Convention—Dallas.
21-23..Mid-West Gas Association Annual Meeting & Convention—Hotel St. Paul, St. Paul, Minn.
23-25..PCGA Sales & Advertising Conference—Villa Hotel, San Mateo.
24-25..NEGA Annual Meeting—Hotel Statler, Boston.
24-25..Oklahoma Utilities Association Annual Convention—Biltmore Hotel, Oklahoma City.
31..Pennsylvania Gas Association Distribution Meeting—George Washington Motor Lodge, King of Prussia, Pa.
30-April 1..GAMA Annual Meeting—The Greenbrier, White Sulphur Springs, W. Va.

April

5-7..AGA Sales Conference on Industrial & Commercial Gas—The Shamrock-Hilton, Houston.
5-7..7th Annual Gas Compressor Institute—National Guard Armory, Liberal, Kan.
8-9..Florida-Georgia Gas Association Convention—Biltmore Hotel, Palm Beach, Fla.
19-21..Southwestern Gas Measurement Short Course—University of Oklahoma, North Campus, Norman, Okla.
19-21..AGA Research & Utilization Conference—Hotel Carter, Cleveland, Ohio.
21..Pennsylvania Gas Association's Annual Production Meeting—Drexelbrook Swimming & Tennis Club, Drexel Hill, Pa.
21-22..Indiana Gas Association—French Lick-Sheraton Hotel, French Lick, Ind.
25-27..AGA-EEI National Conference of Electric & Utility Accountants—Roosevelt & Commodore Hotels, New York.
25-27..Southern Gas Association Annual Convention—Galveston, Texas.

May

9-13..AGA Commercial Gas School—Edgewater Beach Hotel, Chicago.
9-13..AGA Operating Section, Joint Distribution & Transmission Conference—Hotels Roosevelt & Jung, New Orleans.
12-13..AGA Eastern Gas Sales Conference—Statler Hotel, Washington, D. C.
16-18..AGA Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.
23-25..AGA Operation Section Production Conference—Hotel Roosevelt, New York.
24-26..Pennsylvania Gas Association Annual Meeting—Pocono Manor, Pa.

June

1-3..5th Annual Appalachian Underground Corrosion Short Course—West Virginia University, Morgantown.
22-25..Canadian Gas Association Annual Meeting—Manoir Richelieu Hotel, Murray Bay, Que., Canada.
27-28..Michigan Gas Association Annual Meeting—Grand Hotel, Mackinac Island, Mich.

KENTUCKY PIPELINE CONSTRUCTION JOB SAVES TIME AND MONEY WITH ROSKOTE COLD-APPLIED MASTICS

Petroleum Exploration, Inc., specified the application of ROSKOTE PIPE MASTICS, by the ROSKOTER method in the construction of its new transmission pipeline from Manchester to London, Kentucky.

The results —

Dollar Savings by
elimination of heating fuel costs, loss from spillage, kettle operation and haulage.
reduction in size of coating crew, and amount of equipment required.

Time Savings resulting from
the continuous and steady application of two coats of quick-drying mastic with the ROSKOTER "minimum crew" coating device.

Superior Protection from Corrosion
because ROSKOTE MASTICS form a flexible pipe coating that is highly resistant to electrolytic action, deformation by soil stress, thermal influences and attack by moisture, acids, alkalies and salts.

Pipeline built from Manchester, Ky., to serve London, Ky.
Engineers: Petroleum Exploration, Inc., Lexington, Ky., and Sistersville, W. Va.
Contractor: Cumberland Contracting Co., Monticello, Ky.

These same savings and benefits can be achieved on your next pipeline project through the use of ROSKOTE COLD-APPLIED PIPE MASTICS. More than 400 gas and oil companies currently use these pipeline coatings which are adaptable for any application method such as brush, spray, glove or line travel operation to lines of any length and diameter.

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Liquefied natural gas developers reorganized

Continental Oil Co., Union Stock Yard & Transit Co. of Chicago, and the Royal Dutch Shell Group have joined to work in the liquefied natural gas field. A jointly owned company will be known as Conch Methane Co. Ltd.

Shareholders are Continental Oil, 40 per cent; Royal Dutch, 40 per cent; and Union Stock, 20 per cent.

Continental and Union have pioneered research in the LNG field through their joint subsidiary, Constock International Methane Ltd. Constock and the Gas Council in the United Kindom participated through a joint company, British Methane Ltd., in the project to ship liquid methane from Lake Charles, La. to the United Kingdom. The first cargo was successfully carried a year ago by the tanker, Methane Pioneer. Since then, the ship has continued to deliver regularly 2000-ton cargoes of liquid methane to a special depot at Canvey Island, Essex, England.

L. F. McCollum, president of Continental, said the purchase did not include all the assets of Constock. Among assets excluded are the tankship and the liquefaction facilities at Lake Charles.

Cheap river crossing?

Not quite, but the right-of-way on Transco's new mainline construction job in Texas did turn into a river of mud recently. About 15 miles of 30-in. line is planned in two sections. Part of one 8-mile spread is shown here. A real river crossing, under the Trinity, is part of the program. That crossing will require a 2⅝-in. concrete coating.

Push plans for line to Willamette Valley, Ore.

El Paso Natural Gas Co. is seeking a temporary certificate to start a $10.5 million gas pipeline up the Willamette Valley of Oregon. The company wants to complete the project before May 1.

The line would cross the Columbia and other rivers, and this work must be done during periods allowed by the Oregon Fish Commission and the Washington Department of Fisheries. The latter has specified that the work must be completed by May 1.

The line would run from Camas, Wash., to Eugene, Ore. Originally, it was planned to run the line just to Salem.

The plan provides for 18 miles of 20-in. pipe from Camas to Carver in Clackamas county; 40.5 miles of 16-in. pipe to Salem; 26 miles of 12¾-in. line to Albany, and 36.3 miles of 10¾-in. line to Eugene. The line will carry Lane county's first supply of natural gas.

New gas supply for El Paso

El Paso (Texas) Natural Gas Co. can build facilities costing $4.8 million to acquire gas from the East Maljamar and Kemnitz areas in Lea county, N. M. (Dockets G-15068 et al).

The project is designed to enable El Paso to buy about 27 MMcfd from Phillips Petroleum Co. Phillips produces the gas from its own leases or buys it from others in the area.

rugged cross-country pipe line *fully protected*

To be practical, performance life of inaccessible installations such as this must be measured in decades. That's why Hill-Hubbell was chosen to apply optimum corrosion protection to this and many similar lines throughout the country.

On your next job be assured of long service life — specify Hill-Hubbell, the name synonymous with quality in mill coated-and-wrapped pipe.

Specify Hill-Hubbell wrapped pipe on your next job . . .

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American U. plans 1st Energy Institute

The School of Business Administration of the American University, Washington, D. C., will present the first Energy Institute on June 27-July 1.

Purposes of the institute are: (1) to promote a better understanding of past trends and to develop a basic appreciation of potential developments in the production, distribution, and consumption of the major forms of physical energy; (2) to bring about a clearer understanding of the nature, interrelations, and mutual problems of the producers and consumers of energy; and (3) to clarify and strengthen the role of private enterprise in the energy industries concerned through improved understanding of the nature and objectives of business-government relationships.

Assisting in formalizing the scope and content of the sessions is an advisory group. Curtis Morris, manager of AGA's Washington office, is a member of the group.

Texas Eastern, Algonquin get construction okay

Texas Eastern Transmission Corp. and Algonquin Gas Transmission Co. have temporary authority to construct $5.4 million in pipeline facilities (Dockets G-18968 et al). The companies also were authorized to render winter peaking service to existing customers until Nov. 15, 1960.

Texas Eastern will construct about 15.7 miles of 30-in. loops in New York, New Jersey, and Pennsylvania. Cost is $3.6 million. The company will deliver maximum daily quantities totaling 212.6 MMcf to 22 existing customers.

Algonquin will install two 2000-hp compressor units at its Cromwell, Conn., station and about 9 miles of 8- and 20-in. loops in Massachusetts. Cost $1.8 million. With the new facilities, Algonquin can provide winter peaking service to 13 existing customers. The 38.8 MMcfd of gas will come from Texas Eastern.

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For more than 14 years Midwestern has helped pipeline operators defeat corrosion problems. The Midwestern line offers a complete selection of anti-corrosion products and includes . . . KERMAC outerwrap . . . KEYSTONE asbestos felt . . . KAPCO rock shield . . . COROMAT underground wrap . . . GLASFAB brand handwrap . . . SPEEDWRAP prefabricated pipe joint cover . . . SPEEDKOTE pipe coating . . . and POLYKEN tape coatings.

Midwestern Products and Midwestern Service have proved to be the mark of leadership in the corrosion protection field. Midwestern's representatives are thoroughly grounded in fundamentals and are up to date on the latest developments in both field techniques and new and improved products.

A Midwestern Man is at your call . . . IMMEDIATELY . . . from any of the nine strategically located Midwestern offices. Your best defense against costly corrosion is a call to the nearest Midwestern office . . . TODAY!

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- Caracas, Venezuela

Panhandle gets rehearing

Hearings are under way on reopened proceedings involving Panhandle Eastern Pipe Line Co.'s use of commodity value in pricing gas it produces itself. Panhandle wants to present additional evidence (Docket G-2506).

In February 1959 an FPC examiner ruled that Panhandle had not shown that it was entitled to use the field price approach in pricing its own produced gas. He allowed only the actual cost.

In ordering the case reopened, the FPC pointed to possible dollar savings to gas consumers and the incentive to continue development of all available gas supplies. Also, it considered the importance of the commodity value issue in determining just and reasonable rates for both pipelines and producers.

The commission noted that the reopening would permit it to consider the augmented record in this case at the same time it considers the "landmark" Phillips Petroleum independent producer rate case now before it for decision.

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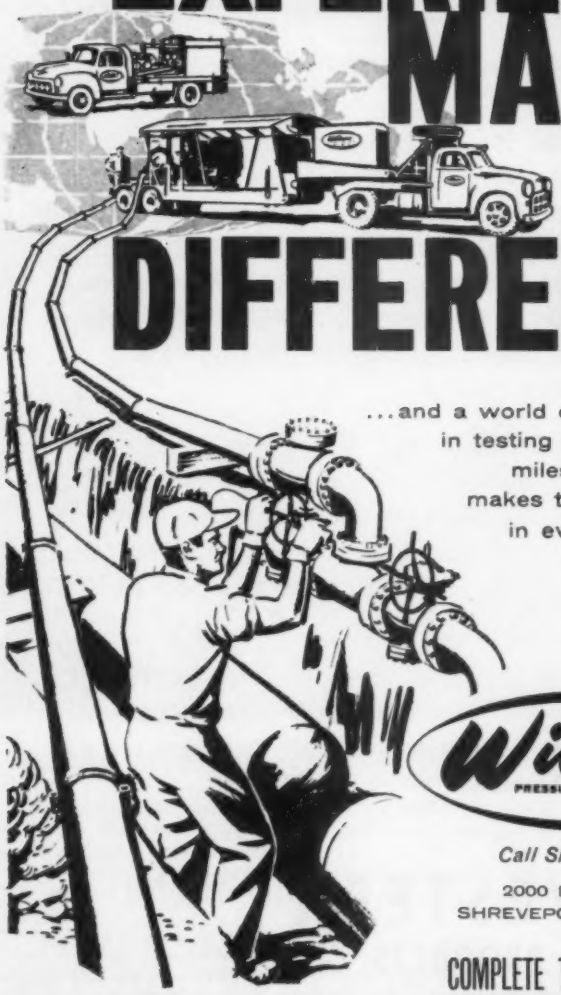

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Gasmen named to petroleum council

Fourteen gas industry leaders have been appointed to the National Petroleum Council for 1960. They are: F. M. Banks, Southern California Gas Co.; Eskil I. Bjork, Peoples Gas Light & Coke Co.; Orville S. Carpenter, Texas Eastern Transmission Corp.; Glenn W. Clark, Mississippi River Fuel Corp.; James Comerford, Consolidated Natural Gas Co.; George R. Copeland, Algonquin Gas Transmission Co.; Paul Kayser, El Paso Natural Gas Co.; Wister H. Ligon, Nashville Gas Co.; N. C. McGowen, United Gas Corp.; William G. Maguire, Panhandle Eastern Pipe Line Co.; L. T. Potter, Lone Star Gas Co.; C. Pratt Rather, Southern Natural Gas Co.; S. C. Whiteman, Kansas-Nebraska Natural Gas Co.; and George S. Young, Columbia Gas System.

Southern merges supply, exploration, production

Southern Natural Gas Co.'s gas supply division and exploration and production division are being merged. The new division, the oil and gas and gas supply division, will be located in Houston.

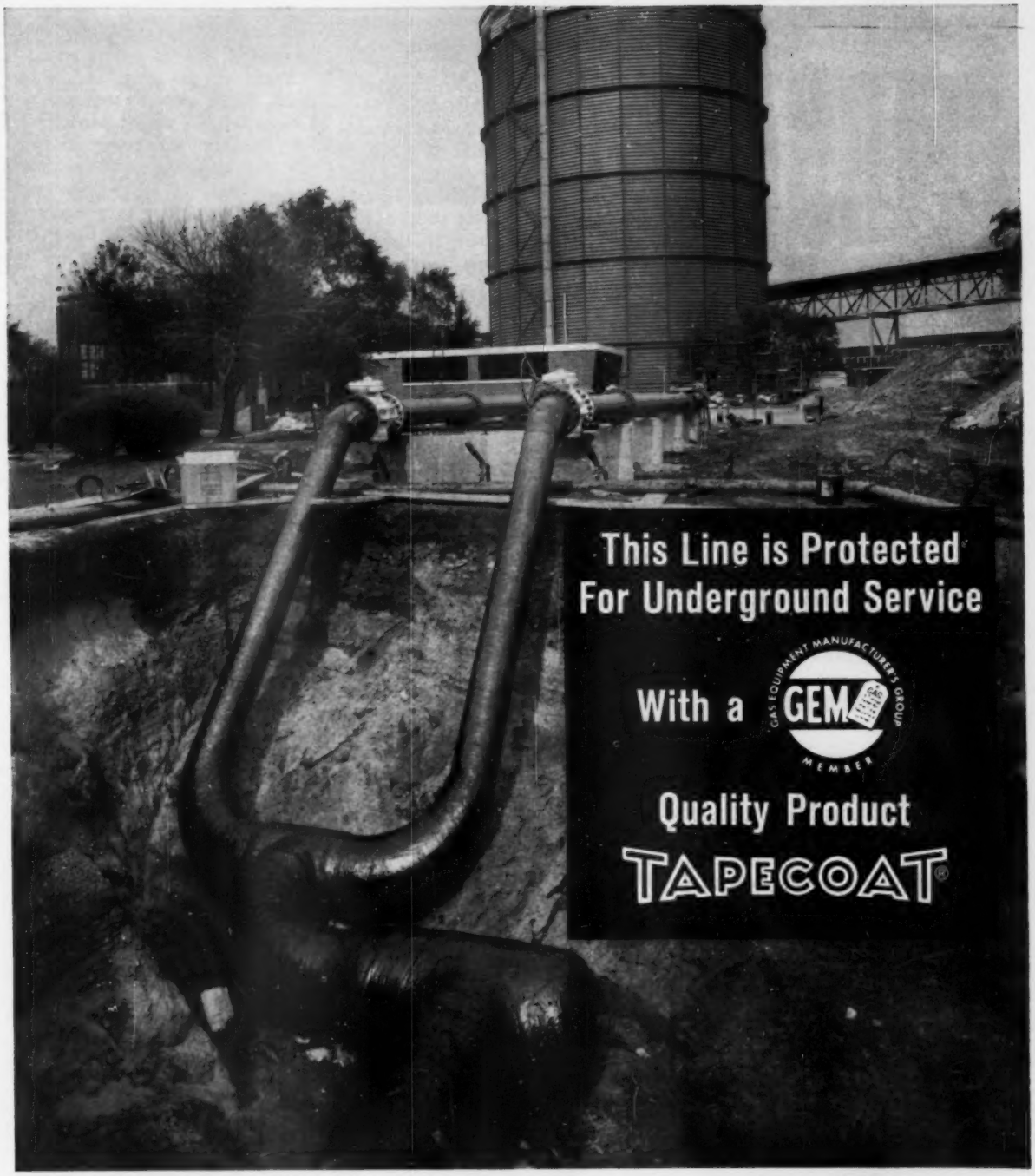
The exploration and production office, until now located in New Orleans, made the move early in March. A district office will be maintained in New Orleans and another in Jackson, Miss.

John M. Starke, until now a vice president of the Birmingham company, is vice president of the new division. W. E. Winn continues as vice president in charge of exploration and production.

TGT plans division office in Lafayette, La.

Tennessee Gas Transmission Co. will move its south Louisiana headquarters from Houma to Lafayette soon. Plans for a new office building are now being drawn.

Housed in the new south Louisiana headquarters will be three TGT operating divisions: Tennessee Gas Pipeline Co., Bay Petroleum Co., and Tennessee Gas & Oil Co.



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Washington • *Cont'd.*

from page 17

Senate-House committee on fuels resources. It would spend a couple of years studying the problems of coal, gas, oil, and atomic energy, and then draft the bitterly controversial national fuels policy.

Resolutions to create this special congressional committee were awaiting clearance for votes in both the Senate and the House in early February.

Whether the coal industry can force passage this year, when indications are that the lawmakers will adjourn early for conventions and campaigns, is doubtful. But the measure will stand a good chance next year if not.

Meanwhile, the internal organization of the coal industry is becoming increasingly strong. As it does, the industry's bid for various government aid and its stepped-up consumer relations campaign also become stronger.

Both the National Coal Policy Conference and the National Coal Association have consolidated their respective staffs, replaced some personnel with highly paid, skilled people, and generally are set to slug it out for markets.

This affects not only pipeline off-peak sales, gas for boiler fuel, and such problems, but the oil industry in its import problems, and similar issues.

Several large oil-gas companies now are beginning to set up their own offices in Washington to supplement existing trade and industry associations in an effort to offset these coal drives. These new offices are mostly "eye-and-ear" operations for the top company brass and for the more openly operating associations.

This may be the big political year, with the public fire coming from clashes between the two major political parties in their race for the White House and control of Congress. But there's also developing a fight just as bitter and just as serious in the fuels industries, although it may (or may not) reach the surface immediately.

CONGRESS may finally take a first step in modernizing this country's outmoded tax depreciation laws for business and industrial equipment and facilities.

These are the laws and regulations which govern the rate and time schedules under which firms may claim tax deductions for wear-and-tear on all types of equipment and facilities from business machines to trucks, meters, and storage facilities.

President Eisenhower in his budget message to Congress urged the lawmakers to in effect raise a part of this tax rate. In exchange for this, Treasury Department officials promised to shorten other phases which would permit an overall lower tax.

At present, the income from the sale of used equipment by a firm is taxed at the 25 per cent capital gains rate. This holds even if the equipment has been completely depreciated for tax purposes. President Eisenhower wants Congress to raise this rate to the normal corporate or business tax rate of the firm, which could be as high as 52 per cent for a corporation, 91 per cent for an unincorporated firm.

In exchange, however, the government would lower its write-off times. Instead of depreciating a truck over five years, it might permit business to write it off over three years, for example. A large piece of equipment might be declared to have a "useful life" of 10 years, instead of 20 years under present regulations. These changes would not take an act of Congress.

The President says that if the tax rate on the sale of depreciated equipment were raised, then the businessman's estimate of its useful life would be more accurate, and faster write-offs could be permitted.

The Senate Small Business Committee points out that inadequate depreciation laws are slowing the country's economic growth by hindering investment in new facilities. It contends present laws ignore inflation and rapid technological improvements. ■

NEWS FROM DOWN THE LINE!

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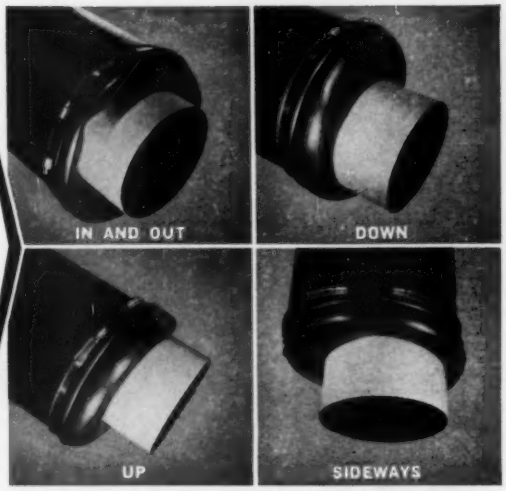
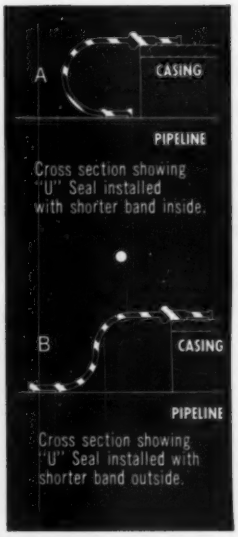


❷ "This is a special demonstrator to show the flexibility of the "U"-Seal. Notice how it maintains its seal regardless of the change in pipe position in relation to the casing."

❸ " . . . Here the "U"-Seal is shown installed in the new "U" shape with the shorter band inside , which allows extreme flexibility. The "U"-Seal can also be installed with the shorter band on the outside in WmSon's familiar "Z" shape. In either case, only a screwdriver is needed to tighten the two stainless steel bands."



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REPRESENTATIVES AROUND THE WORLD

GAS Pipeline People

R. W. HARRIS, recently named vice president of El Paso (Texas) Natural Gas Co., is manager of the company's new Rocky Mountain region, headquartered in Salt Lake City. H. P. LOGAN is superintendent of operations of the newly created northwest division of the Rocky Mountain region. Logan formerly was assistant superintendent of the San Juan division at Farmington, N. M.

EUGENE L. MILLER, president of Cooper-Bessemer Corp., Mount Vernon, Ohio, has been elected president of the Diesel Engine Manufacturers Association. He succeeds JOHN N. MACKENDRICK, board chairman of Clark Bros. Co., Olean, N. Y.

J. GRANT SPRATT has been appointed to the board of directors of the Alberta Gas Trunk Line Co. Ltd. He replaces J. A. ARMSTRONG.

MURRAY B. QUIGLES JR. has been promoted to district drilling and production superintendent of Union Producing Co., United Gas subsidiary. He headquarters in Houston. Quigles succeeds QUINCY L. HENSON, who has retired.

A new operating division for the administration of Tennessee Gas Pipeline Co. activities in the southern Louisiana-Mississippi area has been set up. FRED CLARKE, former district pipeline superintendent at Houma, La., has been made superintendent of the new division. Involved are compressor station operations at Kinder and Leeville, La., and Bay St. Louis, Miss., and pipeline maintenance activities at Kinder, New Iberia and Houma, La., as well as Bay St. Louis. Division headquarters will be located temporarily in Houma, eventually moving to Lafayette, La. F. D. HILSMAN, right-of-way agent in Louisiana, has been named district pipeline superintendent at Houma, replacing Clarke.

NORMAN G. KIRKLAND has been named area manager, refinery and pipeline sales, United States Steel Co. He headquarters in Los Angeles.

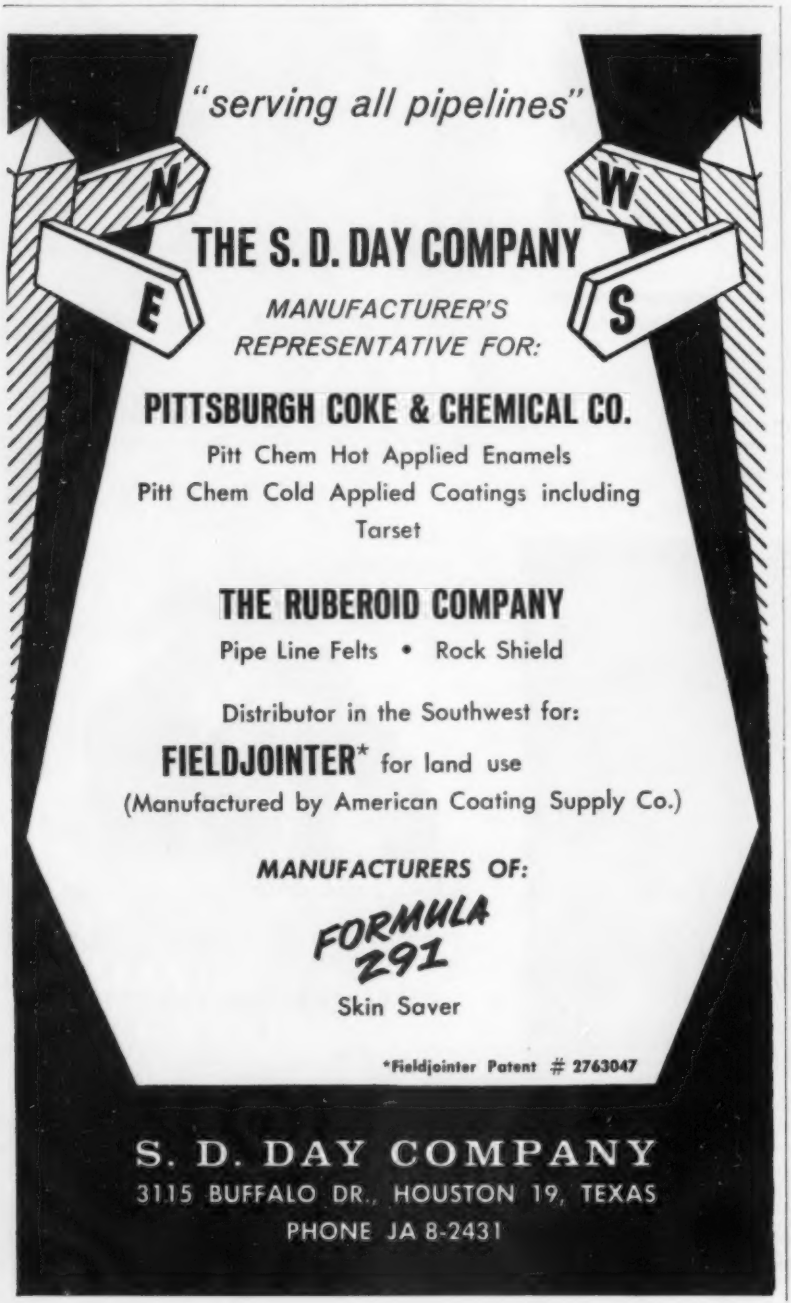
GEORGE R. BROWN, executive vice president of Brown & Root Inc., has been elected to the board of directors of Lone Star Steel Co., Dallas. Brown succeeds the late JOHN W. CARPENTER.

CHARLES R. YARBROUGH has been named natural gas manager for the exploration and producing department of Mobil Oil Co. He headquarters in New York.

JOHN H. CALDWELL has been named southwest district sales manager by Nicolet Industries Inc., Florham Park, N. J. From his Houston headquarters, Caldwell will supervise operations in Texas, New Mexico, Oklahoma, Kansas, Arkansas, Louisiana, and Mississippi.

PAUL DUKE has been elected vice president and director of L. B. Foster Co. Duke has managed the company's regional office in Atlanta since it was established in 1955.

DRESSLER M. PRUETT has transferred to Cooper-Bessemer Corp.'s Tulsa district office as a sales engineer. Since 1957, Pruett has been assigned to the sales department at company headquarters in Mount Vernon, Ohio.



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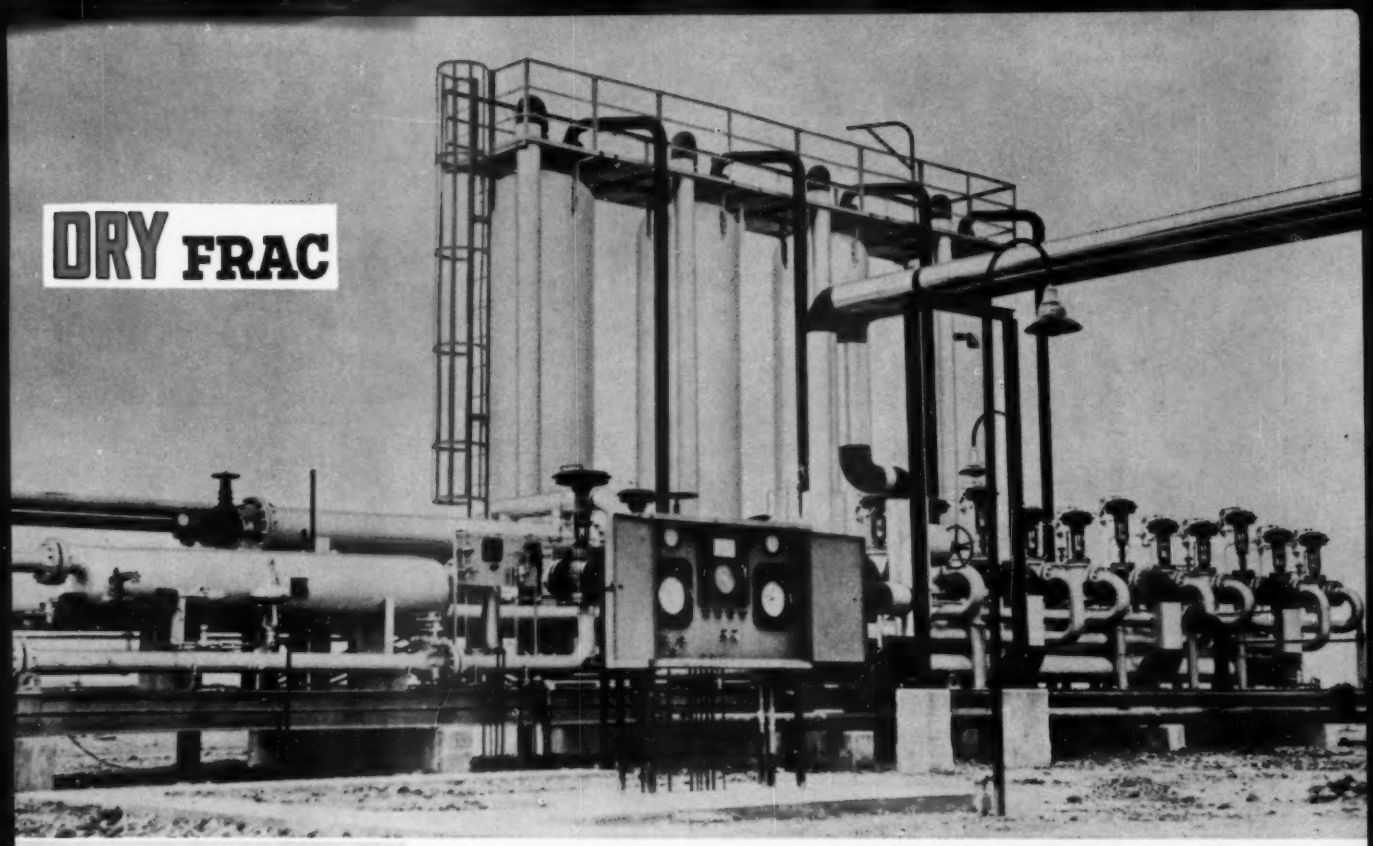

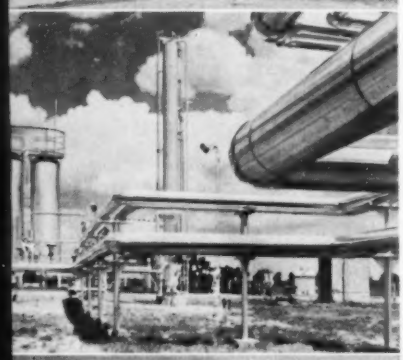

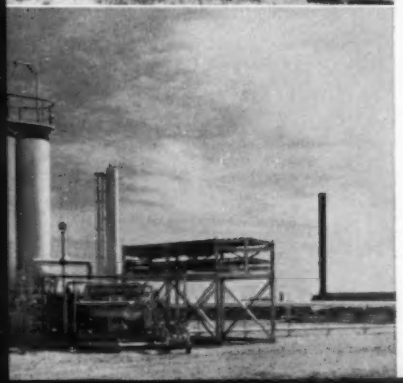

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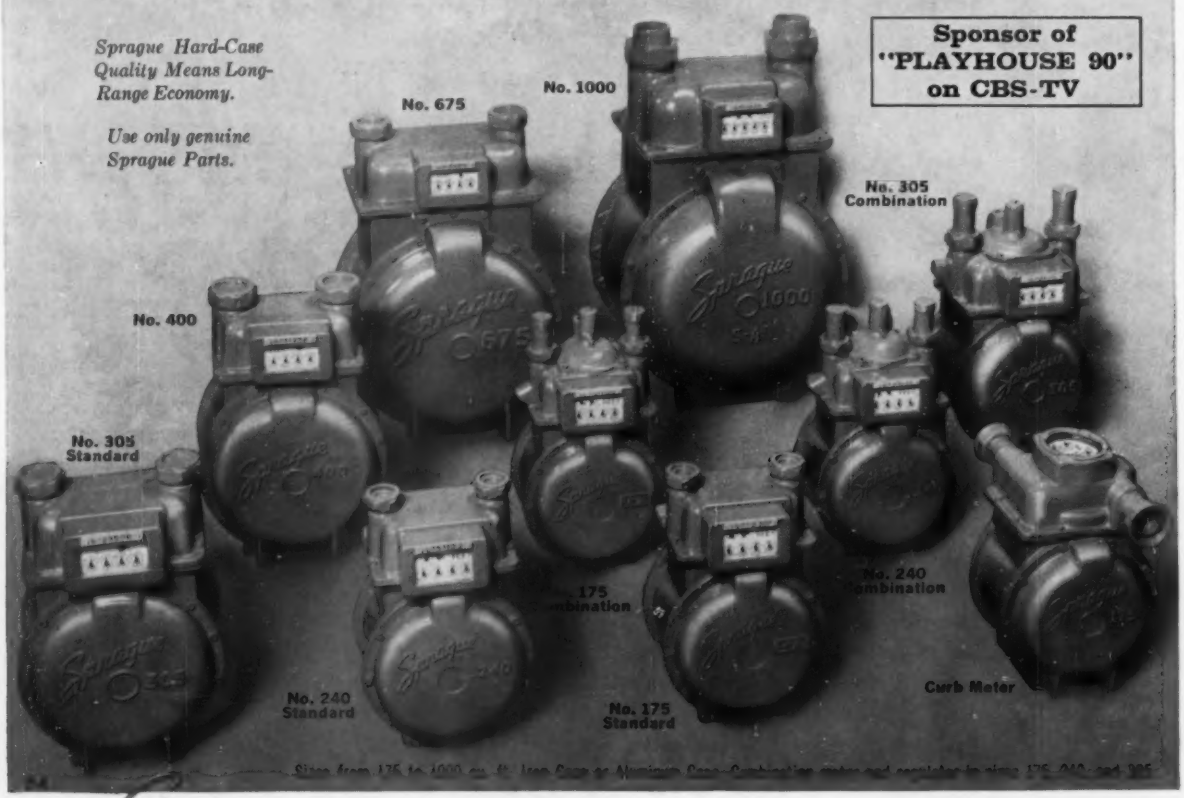

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